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Single Jig Mills in Wisconsin Zinc District

By H. A. Roesler*

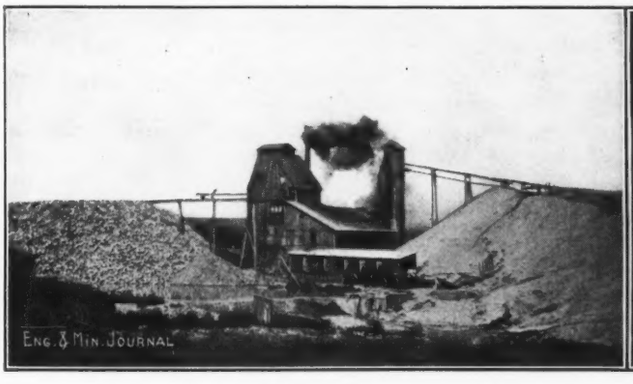
In the Wisconsin zinc district a type of mill is used in which one jig is employed for the concentration of the ore, as shown in the accompanying flow sheet. This differs from the rougher-and-cleaner system, which is generally used, in that the ore is cleaned in one operation instead of being partially concentrated on the rougher jig and subsequently cleaned on a second jig.

Single Jig Suitable for Low-Grade Coarsely Disseminated Ore

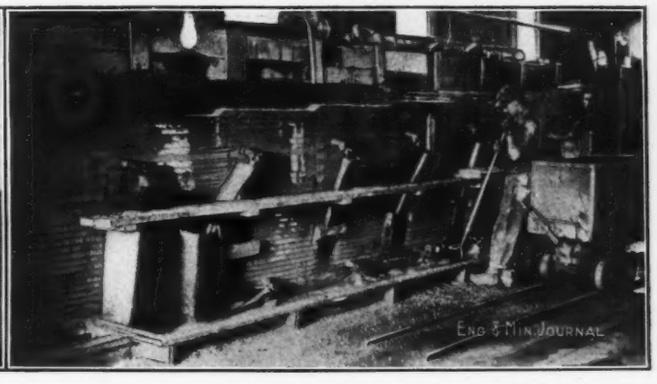
This type of mill is not suitable for all of the ores of the district, but where feasible it has the advantage of being cheaper to build, requiring only two sets of rolls and three elevators, and cheaper to operate because of the lower cost of power, repairs, oil, etc. The factors which determine the feasibility of the single-jig mill are the ratio of iron sulphide to zinc sulphide in the ore and the state of dissemination of these minerals in the gangue. The loss in fines is greater than in the two-jig mills, and where the ore is high in zinc sulphide, it is of too much value to make the system profitable.

With a low-grade ore, that is, containing a low ratio of zinc to iron, the losses are not of sufficient value to warrant a more expensive installation. Further, the iron sulphide slimes more than the zinc sulphide in crushing so that the fines which are lost are of a much lower grade than the concentrate actually made. For economical operation it is necessary to recover a large part of the concentrate from the sieves of the jig in as coarse a condition as possible. If the ore is so finely disseminated or "chatty" that it has to be crushed to ¼ in. or less to free the economic minerals, the loss in fines thus produced will more than counterbalance the saving in investment and operating cost even on a low-grade ore.

The jigs are generally built with seven or eight 30x36-in. cells and are run at a speed of about 200 r.p.m. Such a jig has a capacity of from 100 to 130 tons per 10-hr. day, depending on the richness of the feed. The method of operation differs somewhat from the handling of the rougher-and-cleaner jig system. In the latter, the speed, length of stroke and hutch water are so adjusted on the rougher as to bring about a strong suction effect. This results in bringing into the hutch the greater part of the fine heavy minerals and more or less of the fine gangue. The cleaner, which handles this hutch product, is then adjusted to give a small suction effect which produces a clean concentrate, but causes more or less of the finer heavy mineral to go over the jig, thence returning to the rougher. With the single jig a condition must be maintained which lies between the above. The suction effect must be strong enough to prevent an undue loss of the fines and yet not so strong as to bring fine gangue into the hutch.



Ellsworth Mill, Livingston, Wis.



A Single Jig Mill in Wisconsin Zinc District

It has been shown that suction, following the pulsion stroke of the plunger, affects the smaller particles of both heavy mineral and gangue much more quickly than the larger pieces, due to their less inertia. These will then tend to be drawn down through the coarse particles, but during this operation they are also settling, and of the two, the small, heavy mineral settles the faster. This causes a stratification of the small sizes independently of the large sizes and so forms a protecting layer of the fine heavy mineral through which the fine gangue cannot pass. The large pieces of heavy mineral, however, have a settling velocity which is greater than the total velocity acquired by the small particles, due to suction and settling, so that when the length of stroke is prop-

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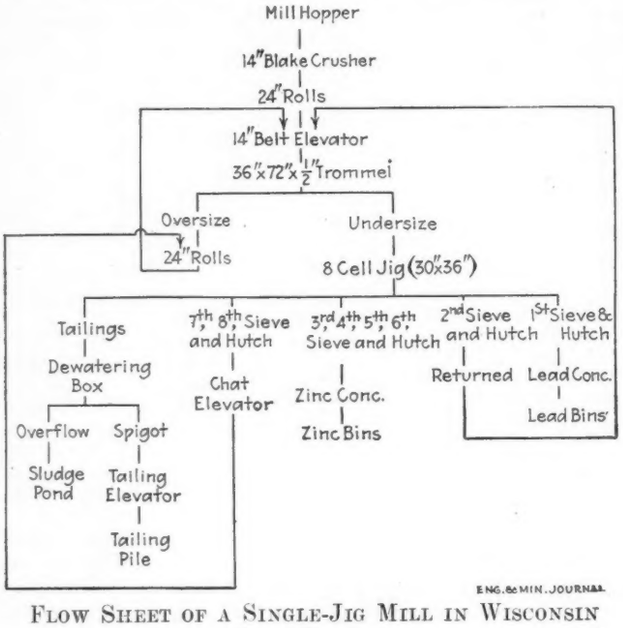
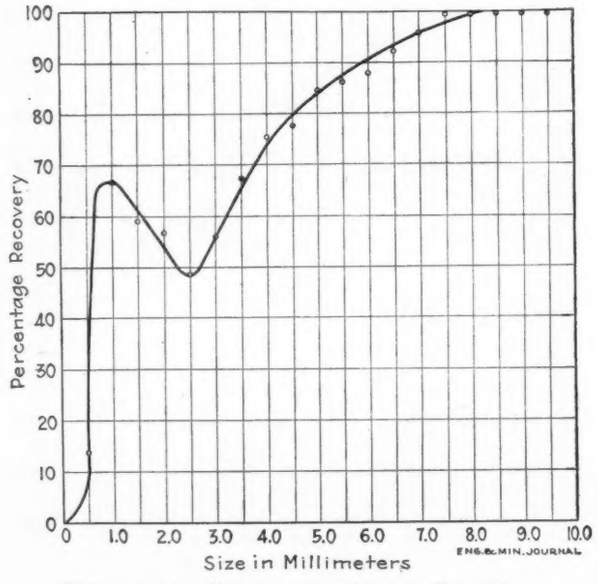
erly adjusted they will reach the sieve before the small pieces and form a layer of coarse concentrates under the fine concentrates even though the latter will start in motion first. The larger pieces of gangue mineral do not acquire a settling velocity which is as great as the total downward velocity of the smaller pieces and they form a layer above the fine.

The stratification takes place then in the following manner, coarse heavy mineral on the bottom, small heavy



FLOW SHEET OF A SINGLE-JIG MILL IN WISCONSIN ZINC DISTRICT



EFFICIENCY CURVE OF A SINGLE-JIG MILL

mineral, small gangue mineral and large gangue mineral on the top, and this sequence is invariably found on the sieve of a properly operated single jig. A portion of the bed of the heavy fine mineral works its way into the hutch at each stroke by going down between the larger pieces. This probably occurs to some extent before the bed has settled to a compact mass, as pieces are found in the hutch, which are too large to go through the interstitial spaces between the large pieces. Some of the smaller particles may also go through after the bed has firmly settled.

There will be a certain size of heavy mineral which is too large to be materially affected by the suction and yet too small to settle with the coarse heavy mineral, and in this size we would expect to have a heavy loss. A large loss would also necessarily occur in the slime which is so fine that it will not settle out from the top water of the jig. This is shown in the accompanying efficiency curve, in which the ordinates represent the percentage recovery and the abscissas the sizes on which these recoveries were made. This was derived from data obtained in a mill test covering a period of five days, during which samples of the various products were taken at approximately two-hour intervals. It is evident that if the relative quantity of zinc sulphide from 0 mm. to 0.5 mm. and from 1 mm. to 4 mm. is large, a low extraction will be obtained, and that to keep the proportion of these sizes small, coarse crushing is essential.

ORE WITH SMALL PERCENTAGE OF LEAD SUCCESSFULLY TREATED

The single-jig mill has been used in a number of cases for zinc ores containing a moderate amount of lead with satisfactory results. The lead is taken off from the first sieve and the first hutch and the second sieve and hutch is returned to the jig. In one instance where the ratio of lead to zinc is higher than usual, difficulty has been experienced in making a zinc product commercially free from lead and it is quite probable that in an ore with an exceptionally high percentage of lead this type of mill, as at present constructed, would not do.

Summarizing, the advantages of the single-jig system over the rougher-and-cleaner system are, low cost of installation and operation, and the disadvantages, that it is suitable only for low-grade, coarsely disseminated ores comparatively free from lead.

Ahmeek Mining Co.

The report of the directors of the Ahmeek Mining Co., of Michigan, for the year ending Dec. 31, 1912, shows 15,950,492 lb. of copper sold at an average price of 16.61c., making a total of $2,649,488. There remain unsold 505,277 lb. of copper, estimated at 15c., making $75,790, a total value for copper produced of $2,725,278. Balance of interest and receipts on silver sales add $32,298 to this amount. Running expenses at the mine were $906,393, construction, $198,114, and smelting, freight, commissions, etc., $187,671, making a total of $1,292,179 for expenditures. This shows a profit on operations for the year of $1,465,396. Dividends of $18 per share, a total of $900,000, were paid.

The total cost per pound of fine copper was: Mining expense, 5.51c.; construction, 1.20c.; smelting, freight, commissions, Eastern offices, etc., 1.14c., making a total of 7.85c. as cost per pound of refined copper.

Total assets are given as $1,900,971 and total liabilities, $521,762, leaving a balance of assets of $1,379,209.

Plans are practically completed for an addition to the mill, with room for four stamps; two of these stamps will be contracted for immediately, together with extensive recrushing machinery; this equipment will give an additional capacity of about 60 per cent. Work will be started in the spring.

Sinking the Hancock No. 2 Shaft

By Claude T. Rice

SYNOPSIS—The second largest vertical shaft in the Lake Superior copper country was sunk by bucket to a depth of 2600 ft. There a station and bins were made and in continuing the sinking, the muck was raised in buckets, dumped into the bins, thence raised in skips to surface. The shaft was kept covered by movable platform trucks and many safety appliances were devised and used.

The No. 2 vertical shaft of the Hancock Consolidated Mining Co., in the Lake Superior copper country, was sunk about 2000 ft. northwest of the No. 1 or inclined shaft, in order to explore the western lodes of the Keweenawan series. It was estimated that the shaft would intersect the Pewabic amygdaloid at a depth of 3500 ft., and prove a large area in the Portage Lake district that has been practically unexplored.

Although primarily an exploration shaft, the dimensions, 9½x29½ ft. are those of a working shaft, its being the second largest shaft in the copper country. Such a large shaft is required because in testing the native-copper lodes it is necessary to mine the ore on no small scale and to determine its copper tenor by actual milling. The shaft has four hoisting compartments, each 7 ft. long by 5 ft. 2 in. wide, and one 4x7-ft. ladder and pipe way.

Safety Appliances a Feature of the Work

The collar is concreted for a depth of 30 ft. into hard rock. The practice in sinking was approximately that followed in sinking the Tamarack shafts,[1] although the routine was quite different, and improved equipment was used. A feature of the operation was that safety to the workers was considered of paramount importance, and so thoroughly was their welfare looked after that in sinking the shaft to a depth of 3200 ft., only one man was killed.

The shaft was started Dec. 12, 1906, and was 3193 ft. deep Jan. 1, 1912. Frozen ground and other disadvantages attending the starting of a shaft in winter delayed the sinking. The shaft was 1435 ft. deep Jan. 1, 1909, and one station had been cut at a depth of 1200 ft. By Jan. 1, 1911, the shaft was 2668 ft. deep, and stations had been cut on the 1500-, 1800- and 2570-ft. levels. The average monthly progress was 81 ft. when shaft sinking could be continued without interference from other work.

The ground excavated in sinking to a depth of 2600 ft. was raised to the surface in buckets. Then a change was made and at the 34th level a station was cut and bins built. The material was thereafter raised in buckets from the bottom of the shaft to the bins and thence was

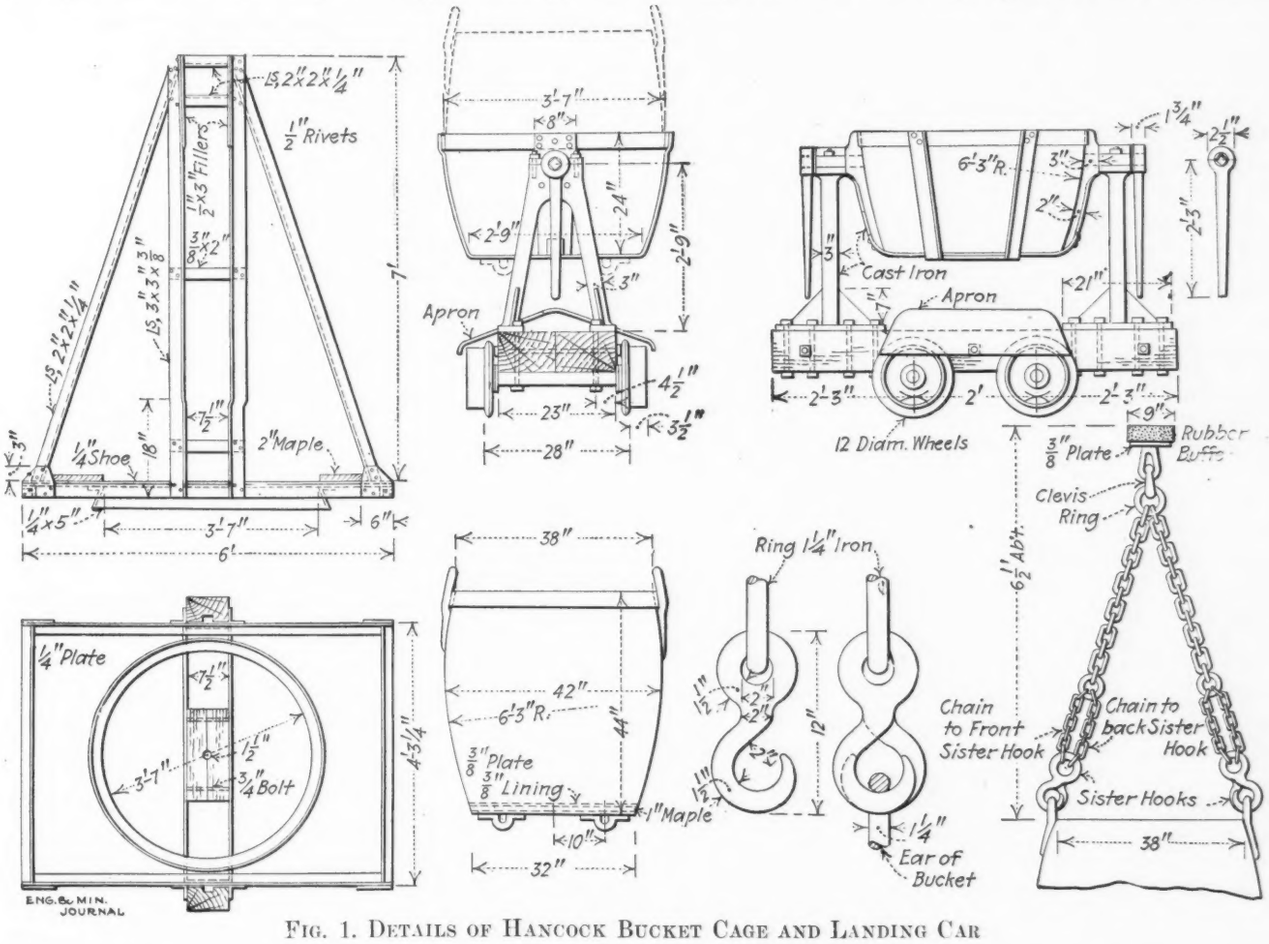


Fig. 1. Details of Hancock Bucket Cage and Landing Car

[1]Proc., Lake Superior Mining Institute, Vol. VII.

discharged into large skips in which it was raised to the surface. A rock pentice was left below the skip compartments and to prevent anything falling down the shaft upon the miners in the bottom, platform covers were used over the compartments in which the buckets were used, both at the 34th level and, in the first stage of the sinking, at the surface.

Bucket Carried by Cage Instead of Crosshead

The bucket was hung from a cage, instead of a crosshead, the details of which are shown in Fig. 1. This illustration also shows the bucket and the cradle and car by which it was moved and dumped. Two chains were fastened to the clevis of the hoisting-rope socket, and on the end of each a pair of sister hooks was fastened, which hooked into ears on the bucket. The sister hooks are also shown in Fig. 1. At first the hooks were fastened together by a pin, scissors-fashion, but were later used as satisfactorily without it. On the bottom of the bucket are two lugs placed so that the pin, that is put through the lugs in attaching the bucket to the cradle when dumping, will be parallel to the line of the eyes of the bucket ears.

In the bottom of the cage a hole 3 ft. 7 in. in diameter was cut, the diameter of the bucket at the top being 3 ft. 2 in. A flanged ring held the bucket in position while being hoisted. There was thus room enough between the bucket and the rim of the hole for the heel of a man's shoe to pass up through as he rode the bucket from the bottom of the shaft to the cage which hung in the shaft on bumpers fastened to the guides at the bottom set of timbers. The hoisting rope passed freely through a hole in the center of the top piece of the cage which was made without a hood, in order to facilitate the lowering of timbers.

The shock of picking up the cage was absorbed by a rubber buffer on the hoisting rope; the buffer being about 9 in. in diameter and 6 in. thick and carried on an iron plate of the same diameter and ⅜ in. thick, which rested directly on the top face of the rope socket. The bucket hung, when in the cage, about 5 in. below the deck, yet entered the flange far enough to be steadied. Friction between a maple filler in the top piece of the cage and the rubber buffer, prevented spinning. The deck of the cage made a fairly tight cover over the hoisting compartment when the cage rested on the buffers at the bottom set of timbers.

Covers Used over Bucket Compartments

At the surface each bucket compartment was covered by a platform that traveled along the guides. It is shown in Fig. 2. As the cage dropped below the collar of the shaft, the corresponding compartment was tightly covered. The cross timbers of the platform extended out so as to catch on the top set of timbers at the collar of the shaft. Extending down from the frame proper of the cover were two guide-shoe timbers so that the top piece of the cage, as it came up, struck these and carried the cover up the headframe ahead of it.

When the bucket was detached from the hoisting cable, the shaft compartment was covered by a sliding platform or landing carriage that was pushed by compressed air across the compartment through grooves in the guides. On this carriage were tracks for the cradle car. In each bucket compartment and at some distance above the collar of the shaft was a gate timber that could be pulled under the cage as a chair to hold the cage while the bucket was being lowered to the cradle car on the landing carriage, which had been thrown in by an air jack. The gate timber was fastened to a counterweight so that, as soon as the cage was lifted, it would move out of the way of the cage.

In making the change of buckets at the surface the car that carried the last bucket sent down on that side would be left standing in such position on the landing carriage that when the carriage was moved into the shaft the car would come directly under the bucket ready to receive it. On the other side of the shaft was standing the car with the bucket in its cradle that had just been dumped. As soon as the cage was down on the gate timber, the landing carriage was run in and the loaded bucket landed in the empty cradle. This car was given a push to the end of the carriage, the car with the empty bucket was run on and that bucket attached to the rope. Then, as soon as the bucket was raised out of the cradle, and had picked up the cage, the carriage was moved out of the way.

Transferring Muck from Bucket to Skip

At the 34th level the buckets were attached and detached from the cable on the same side of the shaft. Fig.

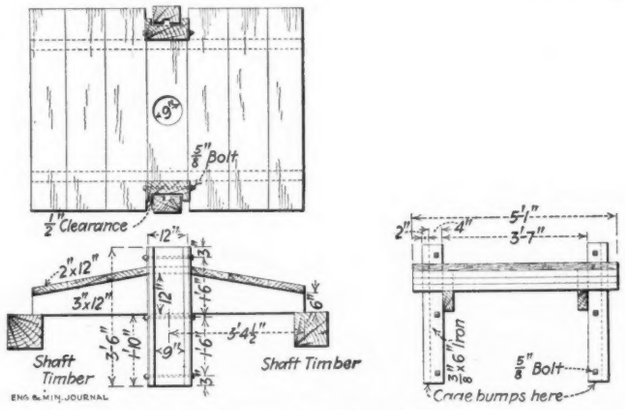


Fig. 2. Cover Platform for Bucket Compartments

3 shows the landing carriage used. This carriage was moved in and out of the shaft by an air cylinder. The carriage was thrown in so that the shaft would be completely covered while the bucket was being landed, and a cradle car was run in under the bucket. In order to allow the carriage completely to cover the shaft compartment the guides were cut in two at the station so that a 3-in. slot was left for the frame planks to slide through as the carriage moved across the shaft, thus no opening was left around the shaft at any time.

Having seen the moving of the bell cord as the men in the shaft signaled to the hoisting engineer to take the bucket up, the three landers, on the 34th level, would open the doors of the compartment and get ready to land the bucket. When the cage had cleared the top of the station, a gate piece, similar to the one used at the surface was pulled in across the shaft so as to catch the cage and hold it while the bucket was lowered. In the meantime the lever to the landing carriage was thrown over, and the carriage run in to cover the bucket compartment. On it was the car with the bucket cradle so placed that when the carriage was in position in the

shaft, the cradle was ready to receive the bucket of muck. Then the engineer was signaled to lower, and the bucket, as it came down, would land in the cradle, at the same time being turned so that the ears would be in line with the long axis of the car and out of the way when dumping. The sister hooks used to fasten the bucket to the hoisting rope were taken off, and the bucket was trammed over to the bin pockets by way of a turntable which was brought in line with the station track as soon as the landing carriage was moved into position in the shaft.

While the bucket was being trammed to the bin, one of the three landers would stick a short piece of round iron through the lugs on the bottom of the bucket so that, as this rod was long enough to extend past the straps forming the bottom of the cradle, the bucket was securely held in the cradle while being dumped.

As soon as the bucket was dumped, the car was run back to the bucket compartment; the sister hooks put in the ring; the hoisting engineer given the signal, and, as the bucket was lifted out of the cradle, the carriage was pulled back out of the way by the air jack. The rubber bumper then struck the top piece of the cage, and as the cage was raised off the gate piece, that timber was pulled out of the way by the counterweight. The bucket was then lowered. The engineer lowered the bucket to about 20 ft. above the bottom of the shaft where he held it until it was signaled down by the muckers. In this way all anxiety of the men in regard to a bucket being lowered upon them was removed. The cage remained hanging up in the shaft on the buffers placed at the bottom of the guides.

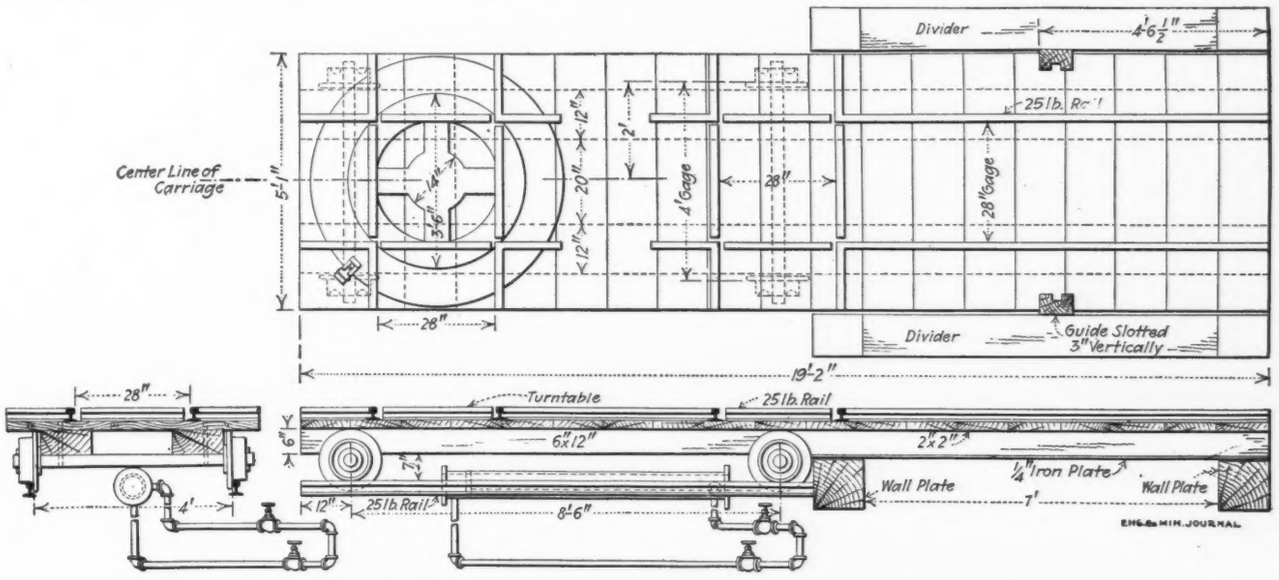


FIG. 3. BUCKET LANDING CARRIAGE USED AT TRANSFER STATION

SKIPS USED TO RAISE MUCK TO SURFACE

The buckets were raised and lowered by a Sullivan 24x48-in. hoist with a double-drum clutch connected to the shaft. These drums were 8 ft. in diameter by 9-ft. face. The speed of hoisting the bucket and its load of 1¾ tons was 2500 ft. per min. Skips were used to take the muck from the 34th level to the surface. These had a capacity of eight tons and weighed about five tons empty. They were of the Kimberley type, and were raised on a 1½-in. rope by a 36x72-in. Sullivan hoist driving a straight-faced drum 15 ft. wide and 15 ft. in diameter, keyed to the crankshaft of the engine. The maximum hoisting speed was 3500 ft. per min. with a total load of 20 tons, including the rope. This engine was fitted with a mechanism for cutting off the steam by automatically closing the throttle valve when a certain point in the shaft was reached.

GROOVED GUIDES CARRIED ON GUIDE STUDDLES

The framing of the shaft sets is shown in Fig. 4. The wall and end plates are 12x12 in., the dividers and the divider studdles 10x12 in., and the corner studdles 12x12 in. The timbers are dapped for the studdles. Behind the guides, 8x10-in. guide studdles are placed, to which the guides are fastened, the dividers being dapped to receive them. The guides are 5x8-in. Oregon fir. These guides are grooved, the groove being 2 in. wide and 1½ in. deep so that, in case a lagscrew works loose and the guide shoe of the skip or cage pulls it out, the screw may drop out along the groove without cutting the guide and possibly causing a wreck. The ladderway is carried up with ladders zigzagged. Sollars are put in 20 ft. apart, as the ladders are 24 ft. long. The legs are 3x4-in. spruce and the rungs ¾-in. iron spaced at 10-in. centers. The sets are put in at 3-, 5- and 6-ft. centers, according to the ground, and in some of the heaviest ground the timbers have been put in at 2-ft. centers. Three hanger-bolts are used to a wall plate.

In sinking, no cover platform for storing machines and protecting the upper timbers from flying rocks is used. At blasting time all the equipment is hoisted to the station at the 34th level. Blasting irons are used to protect the bottom timbers from being cut by flying rock. These are ¼-in. iron plates and are punched with ¾-in. holes so that they can be fastened to the timbers with railroad spikes.

In lagging the sets, 3-in. hemlock planks are used. These are carried on 2x2-in. lagging strips nailed to the back of the wall and end plates. In order to hold the

sets securely the wall and end plates are blocked continuously so that they cannot shift unless the ground itself moves. The space behind the lagging is filled in with slabs of hemlock and other waste blocking so that little open space is left. Bearer sets are put in about 50 ft. apart, although in some places they have to be much closer together. Above the 30-ft. pentice at the 34th level the skip compartments are concreted off to form a water-tight sump.

the shovelers come on. Then the shovelers can go to mucking as soon as they get to the bottom of the shaft. This allows the machinemen to start drilling quicker.

No Timber Crew Employed

Generally it is possible to let the timbering go until Sunday. If that can be done, the men work an extra shift Sunday, timbering the shaft. If not, the drilling has to stop while the men do the timbering. A special

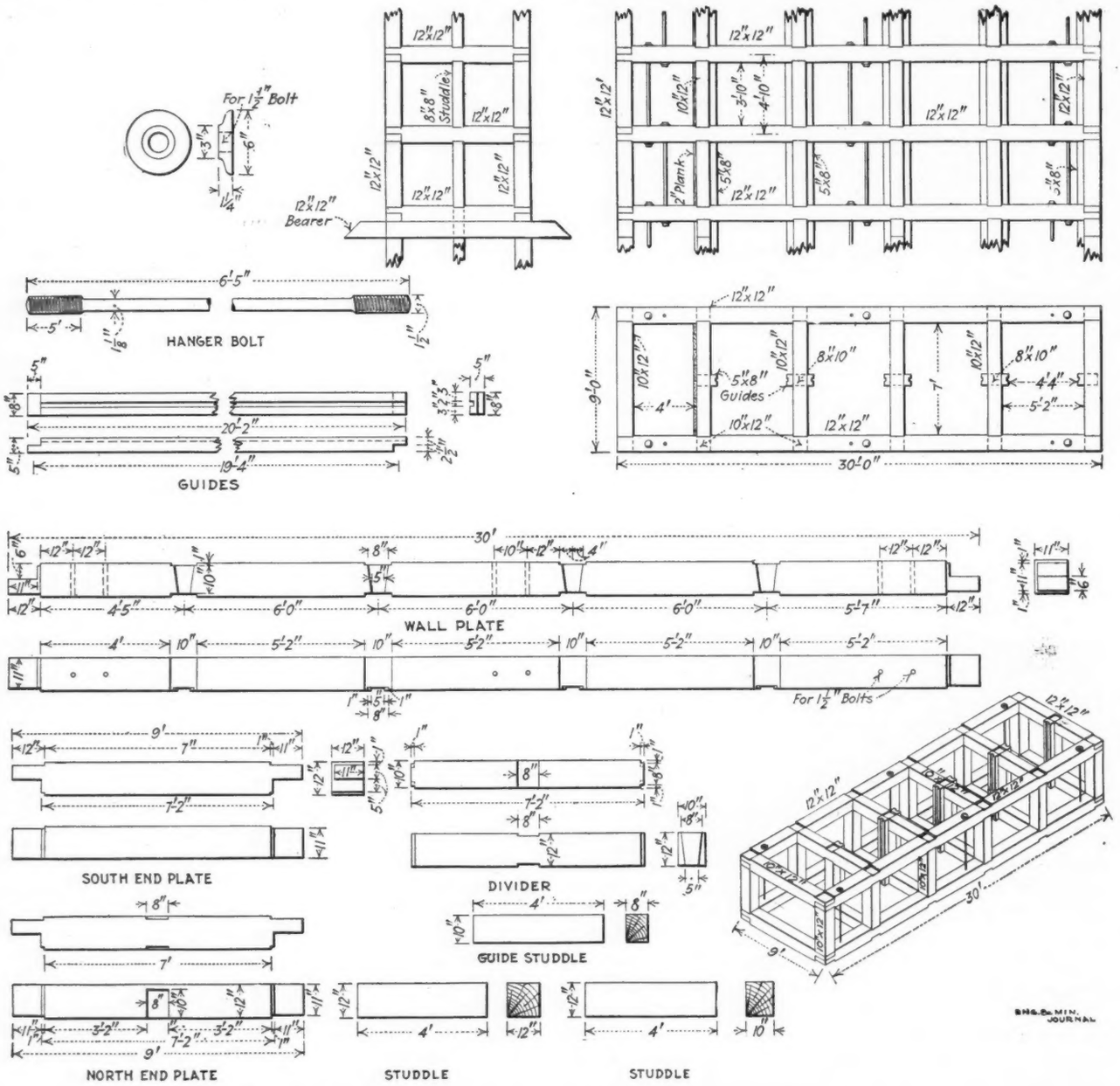


Fig. 4. Timber Sets Used in the Hancock Vertical Shaft

Sinking is done on three shifts of 8 hr. each. The shovelers work a morning and night shift, and are permitted to go home as soon as they have the bottom clean. The machinemen do the timbering, being helped by the muckers. After blasting, the machinemen help the muckers fill the buckets until enough of the bottom has been cleaned to enable the machines to be rigged. Blasting is done twice daily and just early enough so that the machinemen can come down and clean the timbers before crew of timbermen would bother the machinemen, so that they could not do much drilling while the timbering is going on. Usually there are four sets to be put in on Sundays. These will be blocked and lagged in about two shifts. Before timbers are put in, a cut is always blasted so that the timbers will not be shaken so much in working away from them.

The shaft work requires underground three shifts of six miners each, two shifts of seven muckers each, and

two shifts of three landers each, at the 34th level station, while on surface there are two shifts of a hoisting engineer and helper, each. A leading miner on each shift looks after the work in the shaft when the shift boss is in another part of the mine.

Three machines are used on a bar about 10 ft. long. The three machines are kept running most all the time that the bottom is being cleared while a spare machine is kept set up on another bar so that it can be run as soon as the bottom is cleaned enough. In this way four machines are run part of the time while the three regular machines run about 15 hr. out of the 24. A regular shaft bar with a single screw at the end is used. The machines are all rigged on arms, and on each arm is a collar carrying a leg to steady the bar under the hammer of the three machines, which would otherwise make it difficult to keep the bar tight.

The shaft makes but little water, and all of it is hoisted in the bucket with the muck. A 6-in. air main is carried down the shaft, reduced to 4 in. at the bottom. From this 4-in. pipe a ¾-in. nipple is tapped off for each machine as well as for a blowpipe that is kept

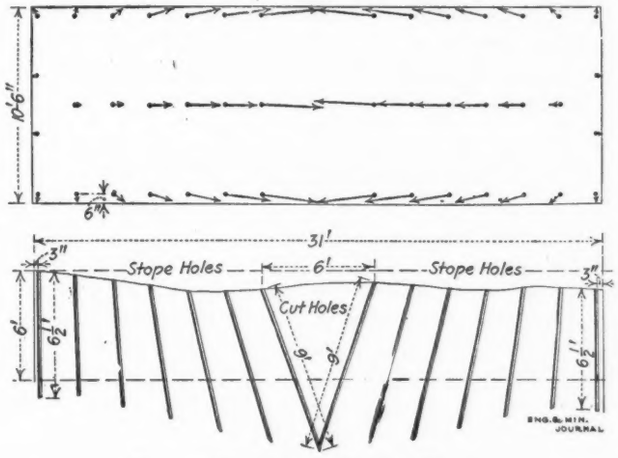


FIG. 5. ROUND OF DRILL HOLES

handy all the time for blowing out the holes when they do not mud properly. The air pressure is 80 lb. per sq.in., and 3⅛-in. machines having a Rand valve with Ingersoll back-head and rotation are used. Cross bits are used on all except the 10-ft. drills, all of which and a few of the 8-ft. drills are made with a chisel bit.

The round is usually broken with from 40 to 44 holes, as shown in Fig. 5. The shaft is broken, 10½x31 ft., so as to leave plenty of room for the timbers without any pop shots being required at the sides. A V-cut is taken a little to one side of center, and wherever is the deepest part of the shaft. The cut is alternated from one side to the other.

Silver Discoveries in Norway

The British consul at Christiana reports that considerable discoveries of silver-bearing veins have recently been made at the Norwegian state silver mines at Kongsberg. (*Chem. Trade Journ.*, Mar. 22. 1913). A recent commission recommended that efforts should be made to recover the long lost main silver vein in the "King's" mine, and this has now been found at a depth of about 912 m., running in a width of about 5 m., bearing both sorting ore and silver. A quantity of native silver is also reported to have been discovered in the mine. Moreover, the discovery is reported of two new and important silver-bearing veins, 5 to 8 m. wide, under the adit of the Gottes Hülfe mine, and about 625 m. under the surface.

Mason Valley Mines Co.

The report of the Mason Valley Mines Co., of Nevada, for the year ended Dec. 31, 1912, presents a general financial resumé of the company's condition and a detailed report of Jules Labarthe, manager. The tonnage smelted, during the year was 98,912 tons of Mason Valley ore, 142,910 tons of custom ore, and 15,768 tons of limestone. From the above there were produced 19,849 tons of copper matte containing 16,058,493 lb. of copper, 916 oz. of gold and 49,318 oz. silver. The development work accomplished during the year amounted to a total of 1391 ft., of which 341 ft. was in drifting, 153 ft. in crosscutting, and 887 ft. in raising. No new property was acquired during the year. The electric haulage system at the mine has been improved by the addition of a second 4-ton Jeffrey electric motor and 30 ore cars. An electric pump has been installed at the lower tramway terminal near the town of Mason. Water is secured from the Mason townsite well and pumped through 8000 ft. of 2-in. pipe to a 50,000-gal. tank situated above the mine, from which point water is distributed with sufficient pressure for fire protection. This installation has dispensed with the expense of hauling water by team.

Electric power is secured from the Truckee River General Electric Co., and transmission is approximately 80 miles. All machinery at the mine is operated by electric power, and, with the exception of a few days' shutdown, on account of the burning of one of the company's transformer stations, the supply has been satisfactory.

The smelter was blown in on Jan. 6, 1912, and one furnace has been in continuous operation since that time. The plant consists of two blast furnaces, which, it was estimated, would treat a minimum of 400 tons each of ore per day. These furnaces have exceeded this estimated capacity by approximately 100%, and with the completion of enlargements now in progress, the plant will have a capacity of 1800 tons of ore per day. The Dwight & Lloyd sintering process has been used in handling flue dust, fine ores and concentrates. The two machines have a capacity of 200 tons of product per day. The installation of converters, which has now been decided upon, will materially assist in saving and enable the purchase and treatment of more refractory ores at a profit.

The financial statements show a total charge for mining, development and freight on ore of $181,946. Ore purchased and freight paid on it amounted to $1,036,178, and smelting to $609,895. Total credits include sales of copper, silver and gold amounting to $1,760,083, and for copper in transit or refineries, sold or unsold, but not settled for, an allowance of $828,131. For ore, matte and flue dust on hand at smelter, an allowance of $69,080 is made. Income for rent amounted to $5810.

Nearly all difficulties and problems incidental to the starting of a new mine and smeltery have been overcome, but further efforts will be made during the coming year to improve metallurgical results and to effect other economies.

The Bisulphite Process

The bisulphite process, as practiced at the works of the British Metals Extraction Co., Ltd., at Llansamlet, Wales, was described at the last annual meeting of that company. The ore, after pulverization, is roasted in mechanical furnaces, the sulphurous anhydride being conveyed from the roasting furnaces to the extraction towers. The roasting is done very slowly, 24 hr. being required to finish a charge.

The roasted ore is conveyed to the top of a specially designed tower where a weighed amount is mixed with a weighed amount of water, so as to form a thin pulp. This pulp descends through the tower, meeting the sulphurous-anhydride gas coming up. The agitation produced by the interior construction of the tower brings about such an intimate and effective contact of the pulp with the sulphurous anhydride that by the time the pulp reaches the receiving tanks at the bottom of the tower nearly 90% of the zinc has been extracted.

The solution of zinc bisulphite is drawn off into an apparatus, wherein it is heated, precipitating zinc monosulphite. The latter is calcined, yielding zinc oxide, which goes to spelter furnaces, the Villiers works having been purchased for smelting it. In that works spelter assaying 99.85% zinc is produced, no special difficulty on account of the volume of the oxide or other factors being experienced. This spelter is said to fetch about £4 per ton more than ordinary spelter.

The extraction of zinc in the bisulphite process proper is said to be from 84 to 89% in the case of the better roasted charges. In the treatment of ore containing 28% zinc, the residue, which goes to the lead smelter, contains about 8½% zinc.

❋

The Big Four Mill at Manhattan

The newly completed mill of the Big Four Mining Co., at Manhattan, Nev., was put in commission Mar. 5, 1913. The mill cost about $75,000, and is expected to treat about 120 tons of ore per day. An interesting feature of the ore treatment is that the gold is recovered entirely by amalgamation, the pulp, before passing over the amalgamation tables, being classified and the sand being ground in tube mills. The mill, states the *Goldfield News,* is on the north slope of Big Four hill, the crusher floor being about 10 ft. below the level of the collar of the shaft, a rail tramway for ore cars connecting the two. The building is about 200 ft. long, and has an extreme width of about 60 feet.

Grading was begun last November, and it had been planned to have the mill running by the middle of January, but delay in the delivery of some of the equipment, especially the motors, delayed operations. The ore is delivered into a gyratory crusher, the crushed product falling into bins, from which it is automatically fed to a short belt conveyor that discharges into the bins that supply the 10 stamps. The battery pulp flows to two Akins classifiers, the sand is ground in two 22-ft. tube mills, and the pulp then passes over four amalgamating tables, each 36 ft. long.

The Big Four ore is free milling, and yields its gold readily by crushing and amalgamation. The mine is developed by a vertical shaft 500 ft. deep, with levels opened at 100-ft. intervals. A large tonnage of ore has been developed, and it is said that it will average about $10 per ton; most of this ore being developed above the 500-ft. level. The property has been developed in the short period of two and a half years. In 1910, it was little more than a prospect, with a few stringers showing along the outcrop of the big vein that follows the crest of the hill. It is reported that the mine has produced about $500,000; nearly $300,000 of this coming from the work of lessees and from the royalties on this ore; $40,000 has been paid in dividends.

❋

Solar Energy and Its Utilization

James O. Handy, in an address upon his retirement from the presidency of the Engineers' Society of Western Pennsylvania, gave the following interesting data:

In the tropics, assuming the solar constant as 1800 cal. per hr. per sq.m., we may readily see that the heat per square kilometer will be equivalent to that produced by the complete combustion of 1000 tons of coal. A surface of only 10,000 sq.km. receives in a year, calculating a day of only six hours, a quantity of heat corresponding to that produced by the burning of 3½ billion tons of coal, or more than three times the annual production of coal. The desert of Sahara with its 6,000,000 sq.km. receives daily solar energy equivalent to 6,000,000,000 tons of coal.

It is estimated that as a result of the sun's rays and the presence of moisture and carbon dioxide, etc., in the earth's crust and in the air, the earth produces yearly 32,000,000,000 tons of vegetable matter, which, if burned, would correspond to 18,000,000,000 tons of coal. We can prepare for the exhaustion of coal by studying which types of vegetation produce woody fiber most rapidly, and can use extensive methods of cultivating them for fuel and afterward convert this fuel into energy in the most economic way. There is reason for hope, however, that we may be able to do more than to improve agricultural methods of producing fuel if we take advantage of the fact that many chemical changes are produced by the action of the sun's rays, and that some of these now known, or which may be discovered, may be the basis of a method of converting the sun's energy in dry, tropical countries, quite directly into a form which may be transmitted to habitable countries where it may be used.

❋

The Centennial Copper Mining Co.

The report of the directors of the Centennial Copper Mining Co., of Michigan, for the year ended Dec. 31, 1912, shows sale of 1,196,255 lb. of fine copper sold at an average price of 16.982c., or a total value of $203,153. There are on hand 546,083 lb. unsold at an estimated price of 15c., making $81,912, or a total value for fine copper produced, sold and unsold, of $285,065. Miscellaneous receipts are put at $10, a total of $285,075 total receipts. Running expenses at mine are $204,536, and smelting, freight, commissions and Eastern office expenses are placed at $22,987, a total of $227,523. From this is shown profits of operations for the year, amounting to $57,551, from which the interest paid, amounting to $7039, is to be deducted, making the net profits for the year, $50,511.

Total assets are given at $233,886 and total liabilities, $237,435, showing $3549 of liabilities over assets.

Notes on the Analysis of Zinc Dust

By J. E. Clennell*

SYNOPSIS—A description of the most acceptable methods for determining the constituents of the zinc dust used for precipitating gold and silver from cyanide solutions. Ordinary samples are found to contain about 89% zinc and small quantities of other elements.

The following notes are intended as a supplement to the tests given by W. J. Sharwood in his interesting and valuable paper.[1] An attempt has been made to develop a complete system of analysis, including all the minor constituents, and in some instances a critical examination of the methods given by Sharwood is made.

The constituents to be determined are metallic zinc, zinc oxide, lead, iron, cadmium, carbon and silica.

None of the samples examined were found to contain other ingredients, except oxygen, except in the minutest quantity. All apparently contained traces of arsenic, as a slight smell of hydrogen arsenide was noticed on dissolving in acid. The three samples to be referred to in this paper are characterized as follows: *A*—Of German origin, containing considerable carbon and only a little lead; *B*—Belgian, containing much lead, but little other impurity; *C*—German, containing considerable lead and cadmium, but very little other impurity. This sample was denser than the others.

Determination of Zinc by Sutton's Method

Zinc may be determined either by a direct method, in which zinc as oxide or carbonate is excluded, or by an indirect method, determining the total zinc and the zinc as oxide, etc., and deducting the latter. Both methods should be used, as a check on the correctness of the result. The direct method[2] is quoted herewith.

One gram of zinc dust is weighed into a dry stoppered 200-c.c. flask, mixed with 100-c.c. potassium-dichromate solution (30 gm. per liter) and 10 c.c. of 1:3 sulphuric acid and agitated for five minutes. Another 10 c.c. of acid is then added and the shaking continued for 10 or 15 minutes, when everything except a small earthly residue should be dissolved. The liquid is diluted to 500 c.c. and in 50 c.c. thereof the excess of dichromate is determined by introducing 10 c.c. of 10% potassium iodide and 5 c.c. of sulphuric acid, titrating the liberated iodine with decinormal thiosulphate.

A blank test was made by mixing 100 c.c. of the standard dichromate with 20 c.c. of H_2SO_4 (33% by volume) diluting to 500 c.c., mixing thoroughly, and taking out 50 c.c. This was mixed with 5 c.c. of the 33% H_2SO_4 and 10 c.c. of 10% KI and titrated with $\frac{N}{10}$ thiosulphate.

The difference between the amount of thiosulphate required in the blank test and that consumed in the test on the zinc-dust sample gives the equivalent of dichromate reduced by the zinc. This method depends on the supposition that the dichromate is reduced by metallic zinc without evolution of hydrogen:

$$(a)\quad 3\,Zn + K_2Cr_2O_7 + 7\,H_2SO_4 = 3\,ZnSO_4 + K_2SO_4 + Cr_2(SO_4)_3 + 7\,H_2O$$

No effervescence was observed when the method was tried with the sample of zinc dust, but on trying it with a sample of grain zinc (Baker & Adamson's c.p.) a slight evolution of hydrogen occurred which would tend to give a low result, as the zinc would dissolve without corresponding reduction of dichromate. On the other hand, it is probable that the lead, carbon, etc., in the zinc dust would have some reducing action on the dichromate, tending to give a high result. The finishing point, when starch is used as indicator, is marked by the change from blue to green color of chromic sulphate, and requires some practice to determine correctly. I found it preferable to add the thiosulphate in slight excess and titrate back with $\frac{N}{10}$ iodine until the blue color reappeared, finally destroying this color with a single drop of thiosulphate.

The liberation of iodine takes place according to the reaction:

$$(b)\quad K_2Cr_2O_7 + 6\,KI + 7\,H_2SO_4 = 3\,I_2 + (SO_4)_3 + 2\,MnSO_4 + K_2SO_4 + 8\,H_2O$$

From the two reactions it will be seen that 1 c.c. $\frac{N}{10}$ iodine corresponds to 0.0032685 grams Zn, assuming the atomic weight of Zn to be 65.37, or when the test is made as described above, using 1 gram of zinc dust and titrating $\frac{1}{10}$ of the total solution obtained, 1 c.c. $\frac{N}{10}$ iodine = 3.2685% Zn.

The Method Illustrated

Of the standard dichromate solution 100 c.c. is diluted to 500 c.c. and 50 c.c. taken for test, containing 0.3 grams $K_2Cr_2O_7$. Table I shows the blank-test data.

TABLE I. BLANK TEST WITHOUT ZINC

$\frac{N}{10}$ Thiosulphate Taken	$\frac{N}{10}$ Iodine Added	$\frac{N}{10}$ Solution Used	
61.35	1.15	60.2	60.11
60.55	0.35	60.25	

TABLE 2. DATA OF ZINC DETERMINATIONS

Zinc Dust Sample	$\frac{N}{10}$ Hypo Taken	$\frac{N}{10}$ Iodine Added	$\frac{N}{10}$ Solution Used	$\frac{N}{10}$ Solution Equal to Zn	Zinc %	Mean %
	c.c.	c. c.	c.c.	c.c.		
A	32.4	0.45	32.95	27.27	89.13	89.05
	33.15	0.15	33.0	27.22	88.97	
B	34.4	0.1	34.3	25.92	84.72	84.72
	34.6	0.3	34.3	25.92	84.72	

The Wahl[3] method depends on the reaction:

$$(c)\quad Fe_2(SO_4)_3 + Zn = ZnSO_4 + 2\,FeSO_4$$

The following description is quoted from Sutton (*loc. cit.*):

About ½ gram of zinc dust is put into a stoppered 250-c.c. flask, and to it are added 25 c.c. of cold water. The mixture is agitated and when the zinc is thoroughly suspended, 7 grams of ferric sulphate are added. There is a gentle evolution of heat, and after shaking for a quarter of an hour, the zinc will have completely dissolved with the exception of a slight residue of impurities; 25 c.c. of strong sulphuric acid are then added, and the flask is made up to the mark with water; 50 c.c. of this solution, after dilution with 50 c.c. of water, are titrated with standard permanganate.

The permanganate solution may be standardized on pure metallic iron, according to the reaction,

$$(d)\quad 2\,KMnO_4 + 10\,FeSO_4 + 8\,H_2SO_4 = 5\,Fe_2(SO_4)_3 + 2\,MnSO_4 + K_2SO_4 + 8\,H^2O$$

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[1] "Journ.," Chem., Met. and Min. Soc. of S. Africa, February, 1912. See also "Eng. and Min. Journal," May 11, 1912, p. 943.

[2] Sutton Volumetric Analysis, 10th ed., p. 383, quoted from "Analyst, 25-279.

[3] A. R. Wahl, Journ. Soc. Chem. Ind. 16-15. See Sutton, Vol. Anal. 10th Ed., pp. 382-383.

From equations *c* and *d*, it will be apparent that 2x55.85 parts Fe = 65.37 parts Zn, or 1 part Fe = 0.585 parts Zn. A correction must be made for any iron present in the sample of zinc dust, and also for any ferrous iron which may be present in the ferric sulphate. To determine the latter, a blank test must be made with 7 grams of ferric sulphate, using the same amounts of acid and water as in the analysis, but without zinc. The solution is made up to 250 c.c., 50 c.c. taken out and titrated with permanganate and the amount required deducted from the volume of permanganate used in the analysis. The correction for iron in the zinc dust is per cent. of Fe × 0.585, which must be deducted from the per cent. of zinc found.

It should be noted that the sulphuric acid must not be added until all apparent action has ceased, otherwise there may be an evolution of hydrogen and the result will be low, as in that case a part of the zinc dissolves without reducing its equivalent of ferric salt.

Demonstration of Wahl's Method

Half a gram of zinc dust is taken and 7 grams $Fe_2(SO_4)_3$ added, and treated as described. In making the standard permanganate solution 0.1226 gram pure iron wire (99.858% Fe) required 36.2 c.c. K Mn O_4 or 1 c.c. K Mn O_4 = 0.003385 gram Fe = 0.00198 gram Zn., hence 1 c.c. K Mn O_4 on 50 c.c. tested = 1.98% Zn.

TABLE 3. DATA OF ZINC DETERMINATION BY WAHL'S METHOD

Zinc Dust Sample	K Mn O_4 for 50 c.c.	K Mn O_4 Corrected for Ferrous Iron	Zn Corresponding to K Mn O_4	Zn Corrected for Fe	Mean Zn
	c.c.	c.c.	%	%	%
A	43	42.65	84.45	84.33	84.33
	43	42.65	84.45	84.33	
B	42.45	42.1	83.36	83.34	83.29
	42.4	42.05	83.26	83.24	
C	43.1	42.75	84.64	84.61	84.71
	43.2	42.85	84.84	84.81	

Correction for $FeSO_4$ in $Fe_2(SO_4)_3$ = 9.35cc. K Mn O_4

Correction for per cent. of metallic iron in zinc dust.... A 0.22 x 0.585 = 0.12; B 0.05 x 0.585 = 0.02; C 0.06 x 0.585 = 0.03

This method appears to give lower results than the preceding, perhaps because it is not affected by the presence of carbon. Zinc in the form of oxide or carbonate is of course not estimated by either method.

Indirect Method May Be Used

The indirect method involves a determination of the total zinc and of the zinc as oxide, carbonate, etc.; we shall therefore discuss various methods for determining the total zinc.

It may here be noted that the method described in Sharwood's article makes no provision for the removal of iron, which would affect the ferrocyanide titration. In the present investigation, it was therefore modified as described here, and serves as an example of the indirect method.

Dissolve 1 gram of the zinc dust in 50 c.c. hydrochloric acid (25% by volume). Warm till most of the effervesence has ceased, then boil thoroughly. Decant through a 9 or 11-cm. filter into a 500-c.c. stoppered flask. Add more of the dilute acid and continue heating if any further action appears to take place. Wash thoroughly with hot water, cool the flask and make up to the mark. By this proceeding it was found that the zinc was obtained practically free from lead and cadmium. When a stronger acid (say 50% by volume) was used, both these metals were dissolved to a considerable extent.

Take out two or more portions of 100 c.c. each. Add ammonia in slight excess, boil, filter, wash with hot water into a 300-c.c. flask. Add a piece of litmus paper and neutralize with HCl till the paper is just reddened. Add 5 c.c. concentrated HCl in excess. Make the volume of liquid up to 200 c.c. and heat to about 80° C. Divide the liquid into two equal parts. Titrate one portion with standard ferrocyanide (21.55 grams $K_4Fe(CN)_6 3H_2O$ per liter, in which 1 c.c. ferrocyanide = 0.005 grams Zn) until a drop taken out shows a distinct brown color with a spot of uranium nitrate on a porcelain plate. The uranium-nitrate indicator is practically a saturated solution. Sharwood (*loc. cit.*) recommends a 15% solution, but it was found that 4.5 grams of the salt did not completely dissolve in 30 c.c. water. When this point is reached add the greater part of the reserved portion, and run in within about 1 c.c. of the quantity of ferrocyanide shown by the first titration to be required to complete the reaction. Then rinse in the remainder with a part of the titrated solution and finish drop by drop, testing continually with spots of the indicator until a faint brown tint appears on standing for a few seconds. With care, the endpoint may be observed within about two drops (say 0.1 c.c.) of the ferrocyanide, and a small deduction of about this amount may be made from the final reading. The result may be checked by titrating several more portions of 100 c.c. from the 500-c.c. flask, and a more accurate result obtained, as the necessary volume of ferrocyanide being approximately known, nearly the whole amount may be run in at once. Some time should, however, be allowed for the completion of the reaction, as it is not instantaneous.

The ferrocyanide should be standardized on chemically pure zinc, 1 gram of which is dissolved and put through the whole process as described above. When many titrations of zinc by this method are to be made, it is convenient to have a standard zinc solution corresponding volume for volume with the ferrocyanide, so that the titre of the latter may be easily checked from time to time. It is also sometimes convenient, if the finishing point has been passed, to titrate back with the zinc solution.

Indirect Method in Practice

To make up the ferrocyanide solution, 43.1 grams $K_4Fe(CN)_6 3H_2O$ is dissolved in water and made up to 2000 c.c. which is standardized on 1 gram pure zinc dissolved in HCl and made up to 500 c.c. 50 c.c. = 0.1 gram Zn. 50 c.c. required 20.1 c.c. ferrocyanide, second 50 c.c. required 20.05 c.c. ferrocyanide, 1 c.c. ferrocyanide = 0.00498 gram Zn.

TABLE 4. DATA ON THE INDIRECT METHOD FOR ZINC

Sample	Ferrocyanide for 100 c.c. = 0.2 gram of Sample, c.c.	Zn Gram	Zn %	Mean %
A	37.6	0.1862	93.62	93.75
	37.7	0.1877	93.87	
B	38.1	0.1897	94.87	94.79
	37.9	0.1887	94.37	
	38.2	0.1902	95.12	
C	38.5	0.1917	95.86	
	38.5	0.1917	95.86	96.06
	38.6	0.1922	96.11	
	38.7	0.1927	96.36	

The ferrocyanide method has the disadvantage that an external indicator must be used, and the end point is not absolutely sharp; also the results are somewhat affected by temperature, dilution and acidity of the liquid titrate. The following method was therefore used as a check.

Proceed exactly as described in total-zinc method No. 1 until an ammoniacal filtrate free from iron is obtained, representing say 100 c.c. of the solution from the 500-c.c. flask, or 0.2 gram of the sample.

Heat to boiling in a 250-c.c. flask and add sodium sulphide in slight excess; 5 c.c. of a 10% solution of Na_2S should be amply sufficient. Boil well, allow to settle for a few minutes and decant the clear liquid through a 12.5-cm. filter. Test the filtrate with lead acetate to make sure that Na_2S is in excess. Wash three times by decantation, using each time 50 c.c. of boiling water. Then transfer precipitate to filter and continue washing with boiling water until the filtrate no longer gives a brownish tinge with lead acetate. Without delay, transfer the filter and precipitate to the flask in which the sulphide precipitation was made. Add a slight excess of $\frac{N}{10}$ iodine (usually 50 to 60 c.c. will be sufficient). Wash down the sides of the flask with cold water. Close the neck with a rubber stopper, agitate the flask to break up the paper, and allow to stand a few minutes. Run in $\frac{N}{10}$ thiosulphate till the brown color becomes faint, then add starch solution and finish titration with thiosulphate. Restore color with $\frac{N}{10}$ iodine and again add thiosulphate drop by drop till color just disappears. 1 c.c. $\frac{N}{10}$ thiosulphate or iodine = 0.0032685 gram Zn = 1.634% Zn on 0.2 gram taken. This method is considerably longer than the preceding one, but has the advantage of an absolutely sharp finishing point. Table 5 shows the data of determinations.

TABLE 5. DATA ON SECOND INDIRECT METHOD

Sample	N/10 Iodine Added	N/10 Thiosulphate Added	N/10 Iodine Consumed by Zn	Zinc	Mean Zinc
	c.c.	c.c.	c.c.	%	%
A	61.9	5	56.9	92.97	93.08
	61.9	5	56.9	92.97	
	82.4	25.3	57.1	93.30	
B	61.9	5.1	56.8	92.81	93.46
	82.6	25.0	57.6	94.12	

The results obtained were rather lower than those of method No. 1, but this may possibly be due to a little of the zinc sulphide being oxidized and dissolved during the process of washing. If the standard solutions are not known to be strictly decinormal it is better in this method also, to standardize on pure zinc.

Determination of Zinc as Oxide

This method was the same as that described by Sharwood (*loc. cit.* p. 944) with one or two slight modifications which are noted here. A solvent for zinc oxide was prepared, consisting of water 250 c.c.; c.p. ammonium chloride, 70 grams; ammonia (sp.gr. 0.90) 150 c.c.

Weigh out one gram of the zinc dust and place in a 200-c.c. Erlenmeyer flask closed with a No. 6 rubber stopper. This was used instead of the large test tube and rubber disk described by Sharwood. Add 25 c.c. of the prepared solution, stopper the flask and shake well for five minutes. The agitation must be violent enough to ensure all lumps being broken up. Throw the mixture promptly on a 9- or 11 cm. filter, rinse tube and wash filter with hot water, receiving in a 250- or 300-c.c. flask.

Dilute the filtrate with hot water to about 100 c.c. Add strong HCl drop by drop and test with litmus paper until the liquid is just neutral, then add further 5 c.c. of strong HCl. When phenolphthalein was used as indicator in this process, as recommended by Sharwood, it was found that the solution was still alkaline to litmus after HCl had been added to destroy the color and 5 c.c. additional run in. It is therefore preferable to use litmus.

Heat to 80° C. and titrate with standard ferrocyanide, using uranium nitrate or acetate as indicator as described under total-zinc method No. 1. 1 c.c. ferrocyanide = 0.005 gram Zn = 0.006225 gram ZnO. Zn × 1.245 = ZnO. ZnO × 0.803 = Zn.

Any zinc carbonate present is estimated as its equivalent of oxide. As pointed out by Sharwood, the method is liable to give too high a result, owing to the action of the solvent on metallic zinc and perhaps also on cadmium.

For the standardizing, one gram pure zinc is dissolved in HCl and made up to 500 c.c. 100 c.c. = 0.2 gram Zn. 100 c.c. taken, required 40.65 c.c. ferrocyanide. 1 c.c. ferrocyanide = 0.00491 gram Zn. = 0.00611 gram ZnO. Table 6 shows the data of the test.

TABLE 6. DATA ON DETERMINING THE ZINC AS OXIDE

Sample	Ferrocyanide on 1 gram. c.c.	Zn %	ZnO %	Mean Zn %	Mean ZnO %
A	18	8.84	11.00	8.60	10.70
	17	8.35	10.39		
B	22	10.80	13.44	10.75	13.38
	21.8	10.70	13.32		

Another Method for Finding Zinc as Oxide

Proceed as in method No. 1 as far as the point where the mixture, containing the zinc dissolved in the special solution, is filtered and the filtrate received in a 250 or 300-c.c. flask. Without neutralizing, heat filtrate to boiling. Add 5 c.c. of 10% sodium sulphide. Boil thoroughly, settle, decant clear liquid through a 12.5-cm. filter. Wash three times by decantation with boiling water, using about 50 c.c. water each time. Transfer precipitate to filter and wash with boiling water until free from soluble sulphides, testing the filtrate with lead acetate. Titrate with iodine and hyposulphite as described in total zinc method No. 2. 1 c.c. $\frac{N}{10}$ iodine = 0.0032685 gram Zn. = 0.0040593 gram ZnO. Table 7 shows the data of the test.

TABLE 7. DATA ON SECOND OXIDE METHOD FOR ZINC

Sample	N/10 Iodine Added	N/10 Thiosulphate Added	N/10 Iodine Consumed	Zinc %	ZnO %
	c.c.	c.c.	c.c.		
A	31.0	3.6	27.4	8.96	11.12
	31.0	4.25	26.75	8.74	10.86
			Mean	8.85	10.99
B	36.15	2.8	33.35	10.90	13.54
	36.15	1.3	34.85	11.39	14.15
			Mean	11.15	13.84

The zinc as metal may now be calculated as shown in Table 8.

TABLE 8. CALCULATION OF ZINC AS METAL

	Method No. 1 Ferrocyanide Titration		Method No. 2 Iodine Titration	
	A %	B %	A %	B %
Total zinc	93.75	94.79	93.08	93.46
Zinc as oxide	8.60	10.75	8.85	11.15
Zinc as metal by difference	85.15	84.04	84.23	82.31
Found by ferric sulphate method	84.33	83.29	84.33	83.29

Determination of Minor Constituents

The substances other than zinc and zinc oxide, which usually occur in samples of commercial zinc dust may all

be determined in the same weighed portion, using the following method of separation. A more rapid determination of the lead may, however, be made by another method given later.

For the separation a number of 11 cm. filter papers are dried in a steam oven and weighed at intervals till the weight is constant. For the purpose of weighing, it is necessary to fold the papers and place them in a weighing bottle, allowing them to cool a minute or so before transferring to the balances. Five grains of the zinc dust are weighed out and placed in a 200-c.c. conical flask, to which is then added 50 c.c. of hydrochloric acid (25% by volume). This is heated gently until most of the effervescence has ceased, then boiled for some time, allowed to settle, and the liquid poured off through one of the prepared filters. The treatment with 25% HCl is repeated once or twice, boiling, settling, and filtering each time. It is not absolutely necessary to continue until all the zinc is dissolved. Any particles collected on the filter are then washed back into the flask, and about 5 c.c. of nitric acid added. This should be diluted with at least an equal volume of water. Boil gently to expel red fumes, filter through the same paper as before, but collect the filtrate in a separate flask. Continue washing until liquid passes through neutral, taking care to collect all undissolved matter on the filter. This consists practically of carbon and silica.

The first filtrate (HCl extract) contains most of the zinc, with perhaps traces of cadmium, but practically no lead, and also contains the whole of the iron. The second filtrate (HNO_3 extract) contains the whole of the lead and the bulk of the cadmium.

The first filtrate is made alkaline with ammonia, enough being added to redissolve any precipitate of zinc hydroxide which may form, heated to boiling and filtered to separate iron. Hydrochloric acid is then added till just acid to litmus, then 10 c.c. strong HCl in excess. It is then saturated with H_2S and allowed to stand to settle any slight precipitate of cadmium sulphide, which may be formed.

Lead and Cadmium Determined

To the second filtrate, add 5 c.c. concentrated sulphuric acid. Boil till white fumes come off strongly, cool, add 100 c.c. water, again heat to boiling and cool to room temperature. Allow to stand until the liquid has settled quite clear. Filter, wash with about 50 c.c. of dilute sulphuric acid (10% by volume) to separate lead.

To the filtrate add ammonia until just alkaline, dilute to about 250 c.c., add 5 c.c. concentrated sulphuric acid and pass in sulphuretted hydrogen until saturated. Allow to stand and settle. Filter and wash with water containing a little H_2S. The residue contains cadmium. It is as well to dilute the filtrate still further and again pass H_2S to ensure that the whole of the cadmium is precipitated, but the liquid must be kept sufficiently acid to prevent the precipitation of any zinc which may have failed to dissolve in the first (HCl) treatment and is therefore present in the liquid under examination. The success of this method depends on careful attention to the strength and quantities of acid used. If the amount of acid is insufficient, some zinc may come down; if too much acid is used, the cadmium may remain wholly or partially in solution.

The residue collected on the weighed filter paper, as described above, is dried, with the paper, in a steam oven to constant weight. Deducting the weight of the filter paper (previously determined) we have silica and carbon. After weighing, the paper is burnt to ash and strongly ignited over a blast flame in a porcelain crucible. If the ignited residue is not quite white, it is evaporated with a strong solution of ammonium nitrate and again ignited. Deducting the weight of silica and ash finally obtained, the difference represents carbon.

Silica is determined by deducting the weight of the ash of filter paper from that of the ignited residue.

If a = weight of dried filter paper + residue insoluble in nitric acid, b = weight of dried filter paper, c = weight of ignited residue and d = weight of ash of filter paper, then, silica = $c - d$ and carbon = $a - b - c + d$.

Two Methods for Iron Determination

When the amount of iron is comparatively large it may be accurately determined by method No. 1, when small, it is best to use the colorimetric method No. 2. In following the first method if the precipitate of ferric hydroxide, etc., obtained by treating the hydrochloric extract of the zinc dust, is at all bulky, redissolve in hot 50% HCl and reprecipitate with ammonia.

Wash the precipitate with hot water until free from chlorides and place the flask in which iron was precipitated under the funnel. Pass through the latter about 25 c.c. of boiling dilute sulphuric acid (20% by volume). Place in the flask a strip or coil of sheet aluminum and boil. Continue boiling, adding water if necessary, to keep the volume to about 75 to 100 c.c., until the liquid is colorless and a drop taken out gives no reaction with sulphocyanide on a white plate. Cool and titrate with standard permanganate (say about 0.2% $KMnO_4$. It is not necessary to remove the aluminum before titrating, unless it has become broken up.

The three samples were analyzed by this method, five grams of zinc dust being taken in each case. In the standard solution, 1 c.c. $KMnO_4$ = 0.003385 grams Fe = 0.0677% on a 5-gram test. Table 9 shows the results.

TABLE 9. RECORD OF TESTS FOR IRON BY FIRST METHOD

Sample	$KMnO_4$ c.c.	Fe %	
A	2.0	0.135	0.14
	2.0	0.135	
B	0.62	0.042	0.04
	0.63	0.043	
C	0.87	0.059	0.06
	0.75	0.051	

Another Method for Iron Determination

Dissolve the ferric hydroxide precipitate from the filter in 5 c.c. hot 50% HCl; collect filtrate in a Nessler tube; add 10 c.c. of a 1% solution of KCNS, and dilute to the 50-c.c. mark.

In another similar Nessler tube add 5 c.c. of 50% HCl and 10 c.c. 1% KCNS. Dilute nearly to the mark and run into this latter tube standard ferric chloride solution until the tints in the two tubes are alike. Mix well, and equalize volume in the two tubes.

The ferric-chloride solution is prepared from pure iron wire dissolved in *aqua regia* or HCl + $KClO_3$, well boiled, and adjusted so that 1 c.c. = 1 mg. Fe. It should be tested to make sure that all the iron is in the ferric condition. Following this method the sampler gave the following results: A, 0.22%; B, 0.05% and C, 0.06% iron.

Lead Determined by Rapid Method

The lead in the precipitate obtained by evaporating the nitric acid extract of the zinc dust with sulphuric acid may of course be estimated by any of the ordinary gravimetric or volumetric methods. A more rapid estimation may, however, be made as follows:

Take 5 grams of the zinc dust, dissolve in about 50 c.c. hydrochloric acid (25% by volume), warm gently till effervescence has nearly ceased, then boil, filter and wash with hot water till free from chlorides. For this determination it is not necessary to dissolve every trace of zinc.

Dissolve the washed residue in a small quantity of nitric acid (50% by volume), 3 c.c. usually being sufficient. Boil off red fumes, pass through same filter as previously used, to remove silica, carbon, etc., and collect filtrate in a clean flask. Wash once or twice with hot water.

Add to the filtrate a drop of phenolphthalein indicator, then run in normal caustic soda solution until a pink color is just permanent. Add acetic acid drop by drop with agitation until the color disappears and any precipitate has dissolved. Avoid an excess of acid. Add 5 c.c. standard potassium chromate (1 c.c. = 10 mg. Pb) or as much as may be required to precipitate the lead completely. Boil five minutes, filter through a 9-cm. filter paper, wash with hot water containing a few drops of acetic acid until the washings are colorless and give no reaction with a drop of potassium iodide and starch. Wash back the bulk of the precipitate from the paper into the flask with a jet of cold water. Place flask under funnel and pass through funnel 10 c.c. of cold hydrochloric acid (50% by volume). Wash about three times with cold water. Add more HCl in the flask, if necessary, to dissolve any $PbCrO_4$ or $PbCl_2$. Add 5 c.c. of 10% KI; if any lead iodide forms, add HCl till dissolved. Run in $\frac{N}{10}$ hyposulphite until the brown color nearly disappears, then starch solution and run in the hyposulphite slowly, with constant agitation until only a faint green or violet tint remains. Add one or more drops of $\frac{N}{10}$ iodine to restore the blue color, then a drop of hyposulphite so that the blue just disappears. When much lead is present the final tint is green, owing to the presence of chromic chloride. This process is slightly modified from that given by **A. H. Low**,[4] and depends on the following reactions:

$$(1) \quad PbCrO_4 + 2\,HCl = PbCl_2 + H_2CrO_4$$

$$(2) \quad H_2CrO_4 + 6\,HCl + 3\,KI = 3\,I + CrCl_3 + 3\,KCl + 4\,H_2O$$

from which it follows that 1 c.c. $\frac{N}{10}$ hyposulphite = 0.0069 grams Pb, assuming Pb = 207.1 and I = 126.92. The results are fairly satisfactory if the proper conditions are maintained. It is essential to precipitate the lead chromate in as nearly neutral a solution as possible. If the liquid is strongly acid, the lead may entirely fail to precipitate. Some practice is also required in observing the end point and the solution should be moderately dilute, as the change from blue to green is not easily noted in a concentrated solution.

[4] "Technical Methods of Ore Analysis," 4th ed., Appendix.

Standard Hyposulphite Solution

To standardize the hyposulphite solution weigh out five or more pieces of pure lead foil of about 20 mg. Dissolve in 3 c.c. of 50% nitric acid and boil off the red fumes. Add 10 c.c. water, then a drop of phenolphthalein and run in normal caustic soda until just alkaline. Add acetic acid drop by drop until the pink color disappears and any precipitate formed has dissolved. Add 5 c.c. standard K_2CrO_4; boil five minutes, filter through 9-cm. paper and proceed as described. Tables 11 and 12 show the data on making standard solution and carrying out the determinations.

Cadmium Determined

When the foregoing system of separation is followed, the bulk of the cadmium will, in general, be found together with the lead, in the portion insoluble in 25% hydrochloric acid, but soluble in 50% nitric acid; it is, however, advisable to examine both filtrates.

After separating the lead as described, the cadmium will be present as sulphate, and may be separated as sulphide by passing in a current of sulphuretted hydrogen. The liquid should be dilute and not too strongly acid, and the filtrate should be tested by further dilution and passing in more of the gas, to ensure complete precipitation. A volume of liquid of about 250 c.c., with acid equivalent to about 10 c.c. HCl, was found to give satisfactory results.

When the quantity of cadmium sulphide is small it is best to wash the precipitate once or twice with dilute sulphuretted-hydrogen water faintly acidulated with HCl, then dissolve with a few drops of hot 50% HCl, collect in a porcelain crucible, and a little H_2SO_4, evaporate to dryness and weigh as $CdSO_4$ after ignition. With larger quantities, dissolve the precipitate after washing with H_2S water, in a minimum quantity of boiling 50% HCl. Dilute considerably, say to 200 c.c., heat to 80° C., and titrate with standard ferrocyanide and uranium-nitrate indicator exactly as in the case of zinc. One c.c. standard ferrocyanide = 0.005 grams Zn = 0.0086 grams Cd. One c.c. ferrocyanide on 5 grams zinc dust taken = 0.172% Cd.

In this titration as little free HCl as possible should be present, as the cadmium ferrocyanide is somewhat soluble in the acid.

TABLE 11. COMPLETED ANALYSIS OF ZINC SAMPLES

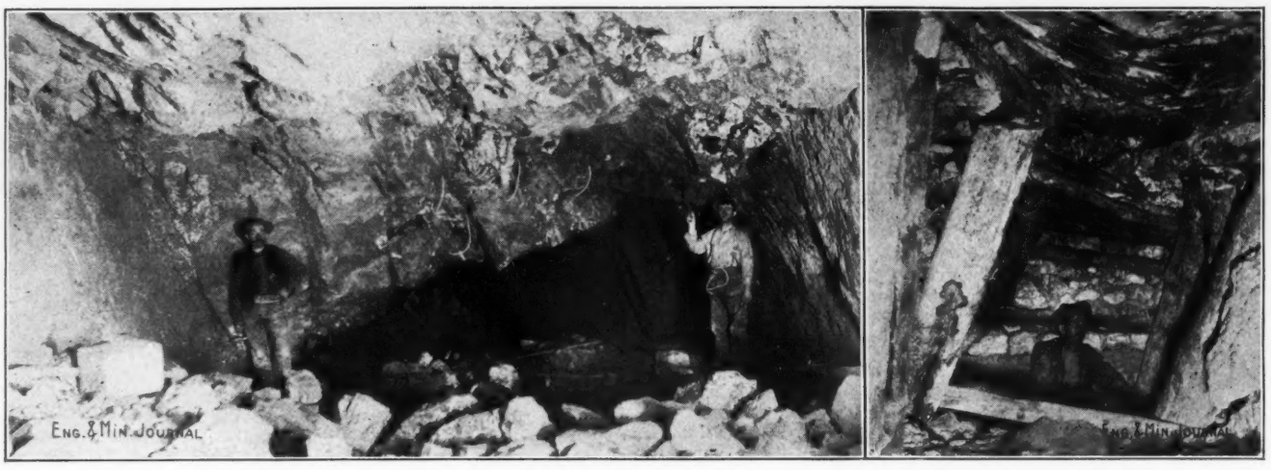
	A %	B %	C %
Metallic zinc, Zn	84.33	83.29	84.71
Zinc oxide, ZnO	10.70	13.38	14.13
Lead, Pb	0.59	2.44	1.76
Cadmium, Cd	0.52	0.17	1.03
Iron, Fe	0.22	0.05	0.06
Carbon, C	2.04	0.04	0.03
Silica, SO_2	0.33	0.13	0.08
	98.73	99.50	101.80

In the analyses shown in Table 10, the titration for zinc and zinc oxide by the ferrocyanide method is taken as correct. In sample C, the zinc oxide was determined only by the indirect method. Table 11 shows the complete analysis of each of the three samples.

Blast Furnaces Stopped by Floods

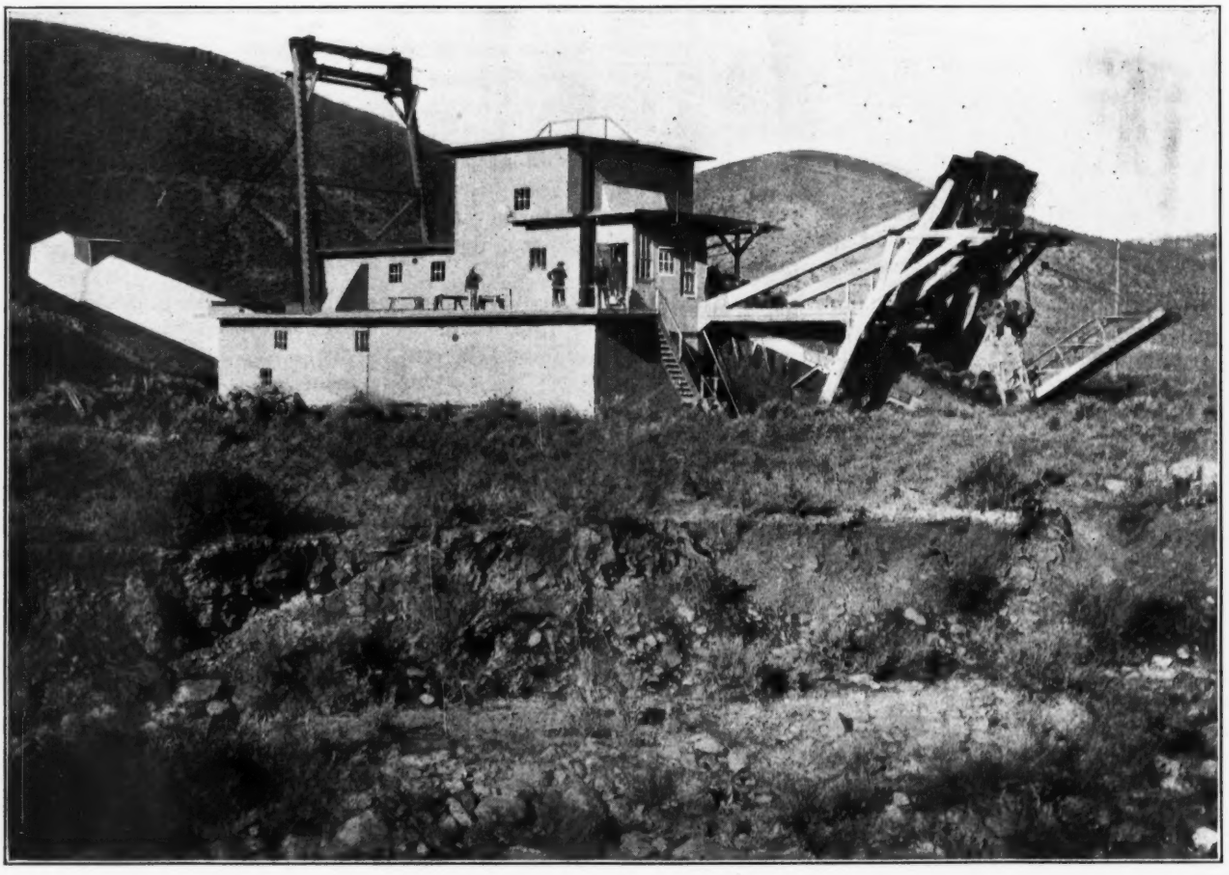
Reports show that the recent floods in the middle West caused 63 stacks to shut down, says the *Iron Trade Review*. Of these, 39 were in Ohio, 10 in Pennsylvania, 3 in West Virginia, and 2 in Kentucky. By April first, 41 had again gone into blast.

PHOTOGRAPHS FROM THE FIELD



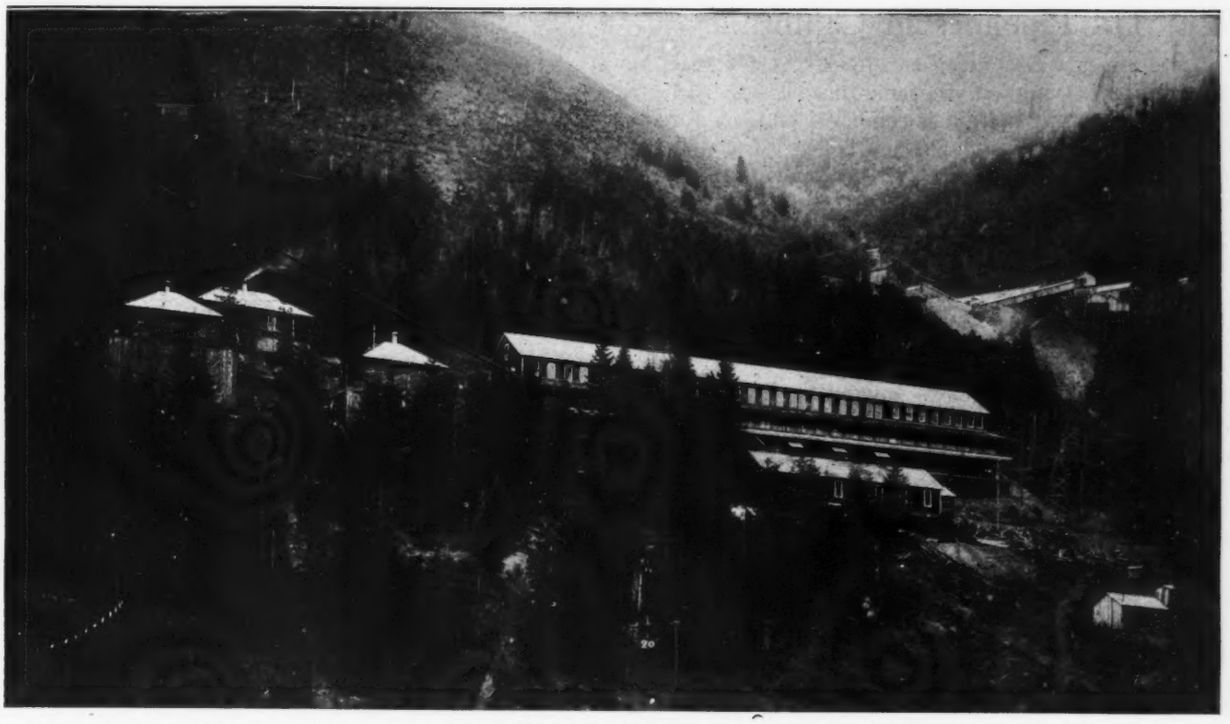
THE DELMAR MINE IN OWYHEE COUNTY, IDAHO

(Ready to shoot in a big low-grade stope.) (Swelling Ground over No. 2 Hamilton raise.)

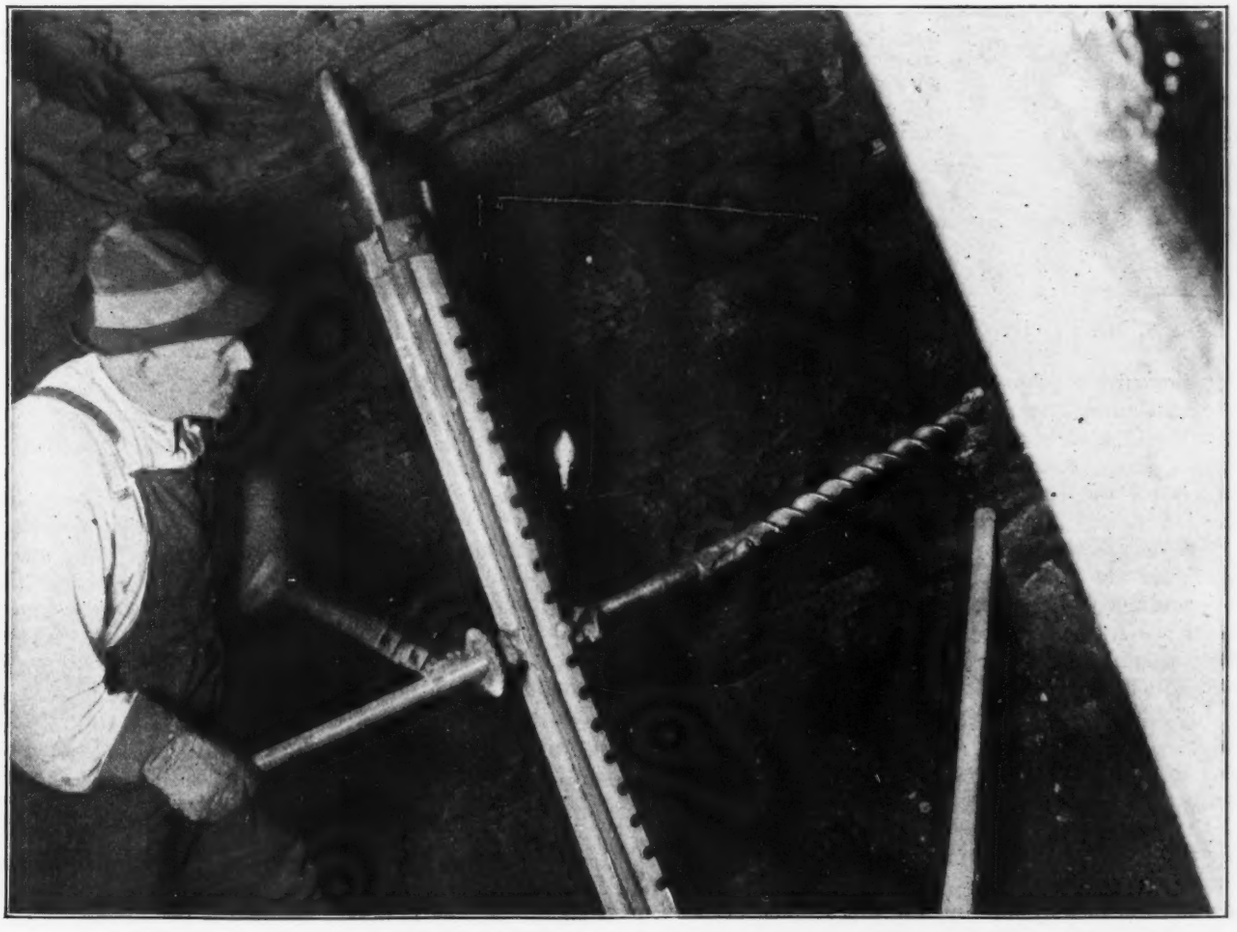


DREDGE OF KIRTLEY CREEK DREDGING CO., NEAR SALMON CITY, IDAHO

(Above halftones furnished by Robert N. Bell, State Inspector of Mines of Idaho.)



STEAM-HEATED BOARDING HOUSE, ACCOMMODATING 350 MEN IN INDIVIDUAL ROOMS AT SNOWSTORM MINE, LARSEN, IDAHO



WATERLOO PHOSPHATE MINE, MONTPELIER, IDAHO. MINERAL OCCURS IN BEDDED VEINS AND IS MINED LIKE COAL

(Above halftones furnished by Robert N. Bell, State Inspector of Mines of Idaho.)

Oil Pipelines in California

There are now several oil pipelines in California, but their equipment is much the same in each case. In general, each pumping station is composed of from three to five water-tube or Scotch marine boilers of 200 to 250 hp. each, fired with oil, and two horizontal duplex compound steam pumps connected in manifold, says B. K. Stroud in *Engineering News,* Mar. 13, 1913. The oil end of the Associated Line Co.'s pumping engine is 9½x36 in. and moves a barrel of oil per revolution. The engines are run at from 12 r.p.m., on heavy oil, to 22 r.p.m. on lighter oil, and will move from 15,000 to 25,000 bbl. per 24 hr. An 8-in. pipe line equipped with these pumps has moved over 30,000 bbl. of oil per 24 hr., or over 1,000,000 bbl. per month. The average, however, is about 22,000 per 24 hr. Each station has from two to five supply tanks of 55,000-bbl. capacity each, set above the pumps when possible. The suction lines are from 20 to 28 in. in diameter. Four men are in charge of each station, working in pairs for alternate shifts of 12 hr. each. Telephone and telegraph lines parallel all pipelines, and the companies have installed shops at important points.

Nearly all the lines are of 8-in. steel pipe, weighing 28 lb. per ft. and tested to 1500 lb. per sq.in. The working pressure is about 750 lb. Openhearth steel pipe is preferred, but bessemer steel is used extensively. The pipe is all made at Eastern mills, and the sections are 20 ft. long. Ordinary screw couplings are used on nearly all the lines, although in some cases there are flanged unions joining the blank ends of the joints. There is practically no leakage at the joints. No air chambers are used, but relief valves are often placed at the summits. The Associated company has a line from the Kern River field to Porta Costa which is rifled, one turn per 10 ft. Water to the extent of 10% forms an envelope between the oil and the pipe and friction is so reduced by this that pumping stations can be set 26 miles apart.

The pipelines, as a rule, have their sources in the warm interior valleys of the state and before reaching the coast have to pass over high mountain ranges, and are therefore subjected to more changes of heat and cold than is usually supposed. The extreme cold at the high altitudes is met by burying the pipes much deeper than in the valleys, the depth being three to four feet below the surface, instead of 20 to 24 in. The General pipeline from Maricopa to Los Angeles has a maximum elevation of about 4000 ft. All the lines terminate a few feet above sea level. In curvature, it is aimed to have a radius of not less than 150 ft. for changes of direction.

In laying its lines, the Associated company cuts a trench 18 in. wide, and the pipe is thrown to opposite sides of the trench every 100 ft., thus providing for expansion. The Standard Oil Co. does not provide for expansion. The lines are buried at least 20 in. deep, and in crossing a marsh or stream are placed on trestles. Protective coatings of especially prepared asphalt are applied after the pipe has been scraped to remove all mill scale; the pipe is then wrapped with an asbestos or fibre paper; and another heavy coat of paint is applied. This work is necessary to protect the line from moisture and alkali in the soil. Pipe-laying, trenching and backfilling machines have been invented which do the work of several men and insure more uniform results. The trenching machines are ordinary power-driven bucket machines, or revolving wheels carrying buckets. Backfilling machines are road graders or V-scrapers drawn by horses.

Pipe Laid by Machine

A pipe-laying or pipe-jointing machine has been invented by Mahoney Brothers which will lay 7000 ft. of pipe per day with a complete crew of 20 men, as against 50 or 60 men with tongs. Fig. 1 is a view of the machine and Fig. 2 shows it on a pipeline. It is run on the pipe, which it uses as a track. The motive power is supplied by a marine or automobile gasoline engine of the four-cylinder vertical type, water cooled, the machine carrying an ordinary automobile radiator and fan. The line runs through a 10-in. pipe or sleeve under the machine and when the latter is ready to travel, the legs which support it on the ground are automatically drawn up until the machine rests on the pipe. A clutch is then thrown in, which causes the small rollers inside the 10-in. sleeve to revolve, thus moving the whole forward. It is prevented from turning over by a long lever on the side, which is handled by the men. The pipeline is supported at the end by blocking and as soon as the machine reaches the end of the joint, the legs are again thrust to the ground and the weight of the machine taken off the line. A joint of pipe is swung in by the boom, automatically placed into position and caught with the grip, which rapidly screws it up. This grip is operated by an ordinary automobile clutch. The machine is further supported when on the ground by cross pieces of wood, which prevent it from turning over into the trench.

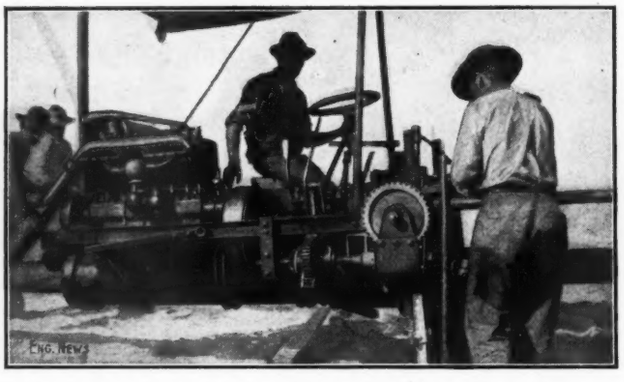


Fig. 1. Machine to Make Screw Joints on Pipe

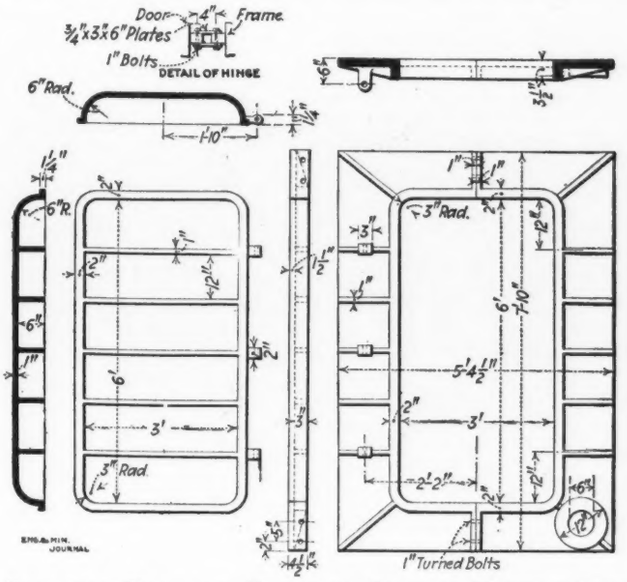
Fig. 2. Laying Pipe with Machine

DETAILS OF PRACTICAL MINING

Cast Iron Door for Mine Water

By H. Beard*

The use of cast-iron doors to resist the pressure of water underground is not uncommon and has been previously described in the Journal. They are particularly useful in controlling the flow where a sudden rush of water is expected or pumping is interrupted by trouble with the pump or with the power. The door and frame shown on the left and right respectively of the accompanying drawing were designed for use by the Alvarado Consolidated Mines Co., in Parral. One in use under a head of 75 ft. of water, is quite tight and others are to be installed to resist heads of 125 to 140 ft. For these greater heads it is advisable to reinforce the frame with



Cast-iron Door and Frame to Control Underground Water Flow

stay-bolts to the roof, floor and walls of the drift. It is estimated that the door will resist a pressure of 100 lb. per square inch.

The door was cast at the local foundry in one piece, the frame in two pieces. The dimensions are as shown and the estimated weight is 2640 lb. for all the pieces. The pieces of the frame are planed where the flanges meet and are bolted together. In one of the lower corners a round flange is cast on with a 6-in. opening for water discharge. The door is self-sealing, there being no provision for holding it against the frame other than the pressure of the water. For this purpose, the faces of both frame and door are planed, and a ½-in. groove ¼-in. deep is planed in the face of the door to take ½-in. square canvas packing. To enable the door to come to a proper seating, the hinges are made with links of ¾-in. plate, as shown, giving some play.

*Alvarado Consolidated Mines Co., Apartado 9, Las Cruces, Parral, Chih., Mexico.

To set the frame in the drift, a small recess in the rock is cut on all four sides and the frame held in this with concrete. In cutting this recess, great care should be taken in blasting and all loose pieces removed in order to prevent leakage. Sufficient room should also be cut out in the back to allow the concrete to be easily tamped into place on the top of the frame.

Oates Fuse Cutting Table

By Herbert Oates*

To facilitate the rapid cutting of fuse to any desired length a table, illustrated in the accompanying drawing, was devised. The board *A*, 1½x12 in x 9 ft., is erected to a suitable height, and the cutting block *B*, ½x½x6 in., fastened near one support. The knife blade *C* is hinged to the block at one end, so that its edge will just pass the side of the block and make a clean cut. This edge should be thin and beveled like a wood chisel. The adjustable clamp *D* is fitted with a thumbscrew, so that it can be shifted to give the desired length. The clip on the end has teeth, but is not so rough that the fuse will be cut. The spool *G* is 3½ in. in diameter and 6½ in. long, built about a piece of ½-in. pipe and closed at the end

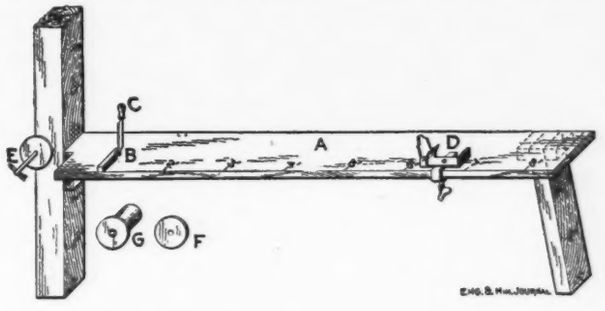


Table for Cutting Fuse Rapidly to Desired Length

with a disk 7 in. in diameter. There is a ½-in. pin *E*, fastened to an upright and a wooden disk *F*, 1x7 inches.

In operation, the coils are separated into the small inner coils and the larger outside coils, and two of the smaller size slipped over *E* and held on by *F*. The ends are brought to bear against the upright end of the clamp *D*, and the clip forced down upon them. The fuse near the coil is held on block *B*, and cut with the hinged knife. The outside coils are manipulated by putting them on the spool *G*, two at a time, and then slipping the spool on the pin *E*. This table should be cheap and convenient and should be a help in utilizing the full length of the fuse coils and in securing the proper rotation of holes. The use of such a table as this with a systematic method of cutting is especially desirable when primers are prepared by special men or gangs.

*P. O. Box 347, Nevada City, Calif.

Brake Friction Coefficients

The braking of high-speed electrical hoists on the Rand has been a subject of discussion lately. The results of experiments made by Prof. L. Klein, in the laboratory of the Technical High School of Hannover (*Zeits. der Ver.* deutsch. Ing., Vol. 47, No. 30, abst. *Journ.* So. African Inst. of Eng., Feb., 1913), have been presented as bearing on the subject. These experiments covered the determination of the coefficients of friction between wood and iron for velocities varying from 200 to 4000 ft. per min. and for pressures varying from seven to

COEFFICIENTS OF FRICTION BETWEEN DIFFERENT WOODS AND CAST AND WROUGHT IRON VARIOUSLY TREATED, GRAIN IN SURFACE PARALLEL TO MOTION

			Beech	Oak	Poplar	Elm	Willow
Cast iron	Brake path clean	Min.	0.28	0.29	0.34	0.32	0.43
		Max.	0.30	0.31	0.37	0.38	0.48
		Mean	0.29	0.30	0.35	0.36	0.46
	Brake path cleaned with petrol	Min.	0.36	0.30	0.39	0.36	0.41
		Max.	0.38	0.32	0.41	0.39	0.50
		Mean	0.37	0.31	0.40	0.37	0.47
Wrought iron	Brake path clean	Min.	0.51	0.48	0.52	0.57	0.41
		Max.	0.56	0.54	0.73	0.64	0.93
		Mean	0.54	0.51	0.65	0.60	0.63
	Brake path cleaned with petrol	Min.	0.52	0.38	0.56	0.47	0.58
		Max.	0.55	0.42	0.62	0.51	0.62
		Mean	0.54	0.40	0.60	0.49	0.60
	Brake path thoroughly oiled	Min.	0.28	0.41	0.49	0.34	0.33
		Max.	0.41	0.59	0.74	0.42	0.45
		Mean	0.35	0.50	0.63	0.40	0.38

142 lb. per sq.in. It was found that for wood along the grain the friction was independent of the velocity and the intensity of pressure, but that it was greater on smooth wrought-iron brakes than on equally smooth cast-iron ones. The results of these experiments are presented in the table. Since unmachined wrought-iron brake rings are common, experiments were made covering these as well, and it was found that they gave a smaller braking force than machined metal because of the wooden brake blocks being pushed away by the uneven surface so that the ring was enabled to pass by with little friction.

Incasing Electrical Shaft Cables

For casing electrical cables in English mine shafts, pitch pine, treated with Stockholm tar, is usually used, the grooves in the casing being cut a little smaller than the cable, so that the cables have to be malleted into place. The tar is for the purpose of protection against water. The objections against this form of casing, according to E. Kilburn Scott, in a paper read before the Association of Mining and Electrical Engineers of England, Feb. 7, 1913, are: That during installation, damage may be done by excessive malleting; that in wet situations it is difficult to exclude water; and that the initial cost of sawed timber and of bolts is rather high. An alternative proposed is the use of split telegraph poles. The pole is sawed in half, and one half is grooved. With the cable in place the two halves are secured by steel bands slipped over and driven toward the butt. The poles should be applied with the butt end down, the small end of the pole below fitting into the large end of the one above, so as to give an extremely tight joint. The poles could be fastened in the shaft by gaining the sides so as to fit over the shaft timber plates and holding them with steel straps. This method would give a cheap protection to the cable and would aid in eliminating the use of armoring. The wood in such a casing, or any casing, should be preserved by some method. Creosote is impossible in contact with electric cables. The most available process would seem to be the Powell saccharine, which has the additional advantage in tropical countries of resisting the attacks of white ants. If tar is used to protect cables and wood, it should be freed from acid and water by boiling before application. The cable should be dried with hot sand, such sand as remains on the cable helping to hold the paint.

Joplin Steel-Sharpening Kinks

By Claude T. Rice

In the lead and zinc districts of southwestern Missouri, "bull" bits, or, as they are more generally called, chisel bits, are employed even on machine steel. It is maintained that these cause less trouble in "blocking the hole," the local term for fitchering. Furthermore, it is possible for one man to sharpen the chisel bits, while two are usually necessary for cross bits. This is a point of great importance in a small property. It is customary to have one man alone do the sharpening for an entire mine up to 125 drills per day.

To handle the larger and heavier pieces of machine steel, however, special devices are necessary. Some of

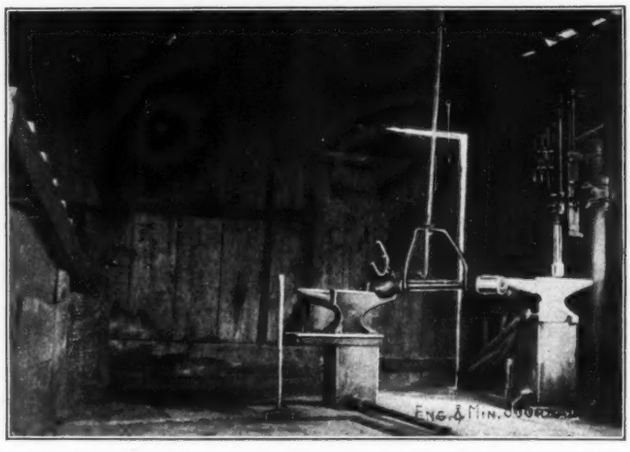


Fig. 1. Typical Joplin Blacksmith Shop

these are illustrated in the accompanying photograph, Fig. 1, an interior view of a typical shop, and others are illustrated in Figs. 2, 3, and 4. In Fig. 1 is seen the usual dressing anvil and an auxiliary anvil under a machine drill used as a hammer. The machine drill is clamped to a pipe, which is buried in the ground. The usual suspension hook for long steel is shown, but the use of the old piston for backing up the steel is original. This piston has one nut of the chuck bolt removed and the other nut fitted with a device for setting it up quickly. At the bottom of the anvil supporting block, an old chuck is fastened in to hold the bits on the "stoving" block. This stoving block is usually a piece of 80-lb. rail with its head buried in the ground, the steel to be stoved resting on the upturned bottom of the flange. The chuck prevents swinging of the steel if it is not struck quite evenly, while stoving.

The process of sharpening is as follows: The hot steel is first placed on the stoving block and stoved back with a two-handed sledge weighing from eight to 10 lb. After the metal has been stoved back to form the bit,

which has a face angle of 130° to 140° ordinarily, the steel is transferred to the anvil under the machine and spread out and battered down to gage. The end of the piston in the machine has a slightly rounded face. The long pieces are supported in the swing, which runs on a piece of 2-in. pipe across the top of the shop.

From this roughing anvil, the steel is transferred to the finishing anvil. If it is a short piece, the piston is found useful to back up the bit with its weight and relieve the smith from shock. The tightening device is shown in detail in Fig. 2. It is made of a piece of old drill steel fitted

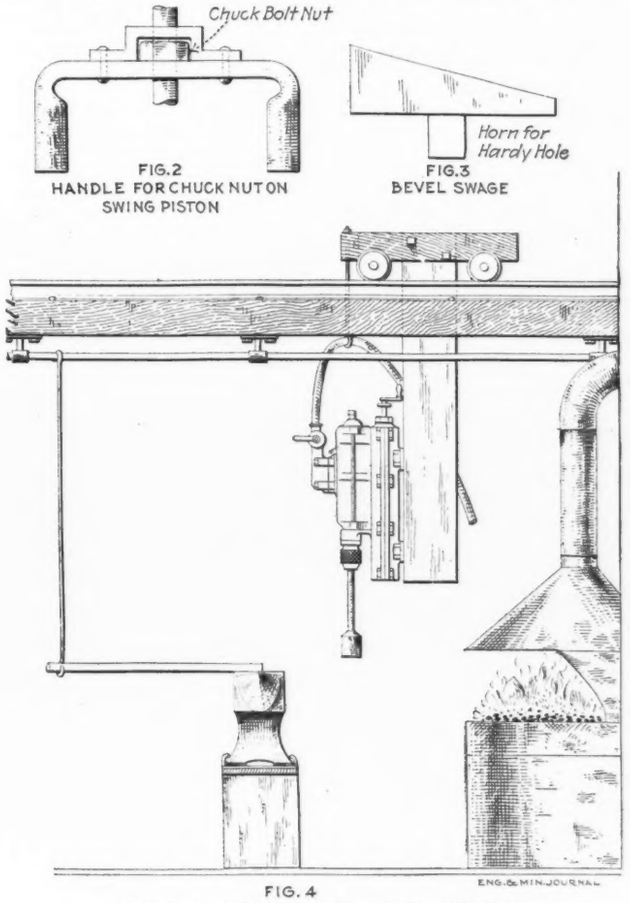


FIG. 4
SHOP WITH MOVABLE MACHINE DRILL HAMMER

JOPLIN MACHINE DRILL-SHARPENING DEVICES

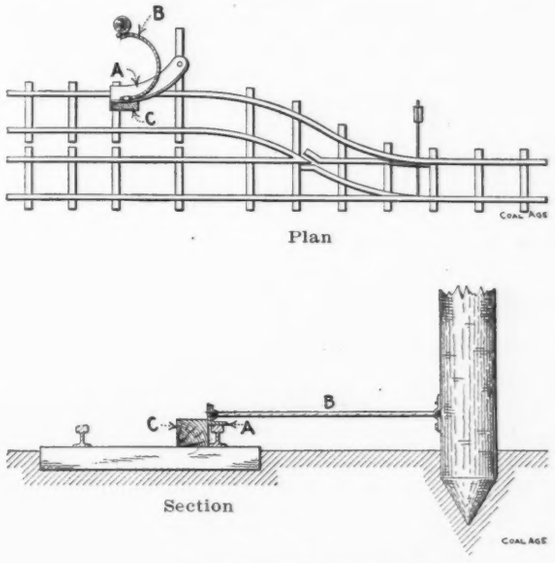
to the chuck-bolt nut and is rather heavy so that by slipping the drill shank in the chuck of the swinging piston and giving the handle a spin, the bolt is sufficiently tightened. The weight of the longer drills is sufficient to take the shock of the dressing blows. In dressing, the bit is usually held up at a small angle so as to bevel down the sides slightly. A hook somewhat higher than the ordinary hook is necessary for this, but the same result can be got by the use of the bevel swage, shown in Fig. 3, which has a horn to fit the hardy hole of the anvil.

The layout of one shop presented in Fig. 4, is somewhat different. In this shop all the work is done on one anvil and the stoving block and roughing anvil are dispensed with. The machine is mounted on an 8x8-in. timber, which runs on an overhead track by means of a truck, as shown, and can thus be brought into service on the one anvil. The air hose for the machine is kept out of the way by suspending it in an eye-bolt hung from the crosspiece of the truck.

Automatic Car Latch for Siding

To prevent cars underground when run upon an incline from sliding back and doing mischief, there is installed in the Sterkrade mine, Oberhausen, Germany, a sort of latch, which lets the car pass freely forward upon the incline, but bars its return. (*Glückauf,* Feb. 22, 1913, abstr. *Coal Age,* Mar. 22, 1913.)

This device, as shown, consists of an angle iron *A*, bent in a circular arc, pivoted beside one rail and resting upon it. A spring *B* made of old wire cable presses this



AUTOMATIC STOP FOR CARS

angle iron against a stop *C*, thus holding it in place. If a car runs forward on the track its wheels push the angle iron aside against the force of the spring. When the car has passed, the spring restores the angle iron to its position against the stop and thus blocks the rail.

Corrosion of Iron and Steel

The corrosion of iron and steel is largely an electrolytic action. When a speck of rust is formed by moisture, according to the *Engineer,* Feb. 28, 1913, a galvanic action is set up between the oxide and the iron, and a center of destruction is started. Thus rust breeds rust, and inasmuch as the oxide is hydroscopic, it is difficult to bar the passage of water where it has once found its way. It has been demonstrated that a portion of metal subjected to varied strains is particularly affected by galvanic action. Plates, for instance, will decay more rapidly at the bent parts than at the unstrained portions.

In the rolling process a hard scale is formed upon steel plates, which is exceedingly difficult to remove except by treatment in hydrochloric acid. If allowed to remain, water usually finds its way beneath it and forms a layer of rust which swells and detaches the scale. It is sometimes customary to let this action take place in the erected material, and subsequently paint the metal. But it has yet to be demonstrated that provided moisture has never been allowed to get a footing underneath the mill scale, the scale will not remain firmly adherent.

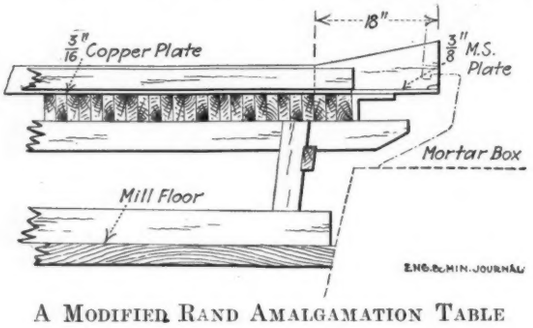
DETAILS OF METALLURGICAL PRACTICE

Improved Rand Amalgamating Tables

What was for a long time the standard type of amalgamation table, used in the mills of the Transvaal, was described in the JOURNAL of Oct. 12, 1912. There has recently been a pronounced tendency to depart from what was long accepted as standard practice upon the Rand. This tendency, according to C. O. Schmidt, in "A Textbook of Rand Metallurgical Practice," is greatly to reduce the length of the table, and in the newest mills on the Rand, although the weight of the stamps has been enormously increased, a much lighter table is now used than was formerly considered good practice.

In the accompanying illustration is shown the head end of one of these improved amalgamating tables. The copper plate is shorter and there is a steel plate at the upper end to take the wear caused by the falling pulp and to prevent damage to the copper plate when handling stamp parts, such as heads, shoes and dies.

When amalgamation was the only means of recovering gold, there was an incentive for lengthening the copper plates, and greatly extending the amalgamating area. With the gradual perfection of the cyanide process, the



A MODIFIED RAND AMALGAMATION TABLE

recovery of the more difficultly amalgamable gold has become a question of less moment. In fact, amalgamation is now essentially a process for removing the coarse gold, the solution of which, by cyanide, would greatly extend the time of treatment required.

❋

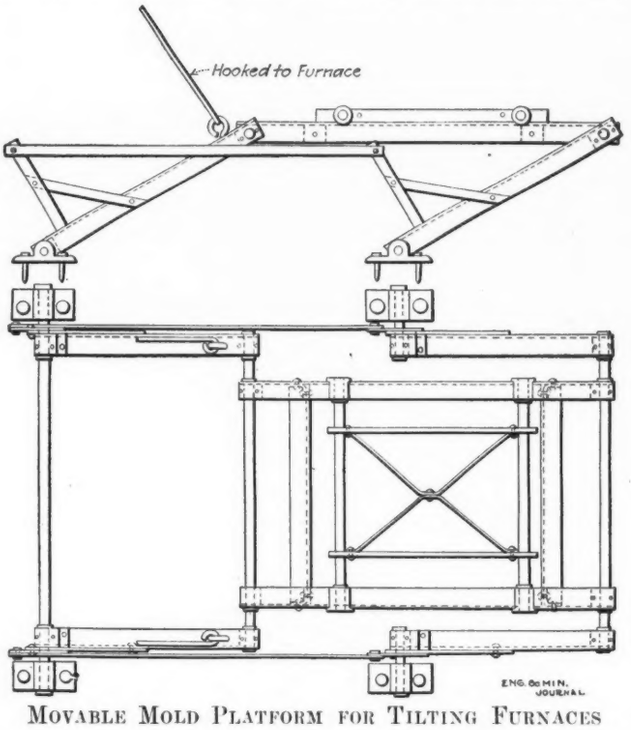
Delicate Qualitative Reactions for Gold

When one volume of a 0.1% solution of certain aromatic reducing agents, such as quinol, pyrogallol, etc., is added to 10 volumes of a solution contains 0.002% of auric chloride, a violet colloidal solution of gold is produced in the course of two minutes (*Analyst*, p. 54, 1913; abstr. *Journ.* Soc. Chem. Ind., Mar. 15, 1913). The colors vary according to the reagent used and the strength of the solution, those yielded by metol (the methyl ether of *p*-aminophenol) and quinol being particularly fine. *p*-phenylenediamine gives a dark yellowish-green solution, which after a time undergoes further color changes, and this reaction, being specially delicate, is suggested as a test for traces of gold salts, for which purpose one volume of a 0.1% solution of a *p*-phenylenediamine is added to 10 volumes of a solution containing 0.0005% of gold chloride; a distinct greenish-yellow coloration is observed even with a solution containing only 0.0001% of the gold salt.

❋

Bullion Mold Platform for Tilting Furnaces

One of the objections to the use of tilting furnaces for melting gold and silver bullion, has been that the mold had to be rather remote from the lip of the crucible, the distance constantly varying, and spilling of the molten metal was almost unavoidable. To correct this defect, the operators at the Tom Reed Gold Mines Co., Oatman,



MOVABLE MOLD PLATFORM FOR TILTING FURNACES

Ariz., devised the apparatus described here, which has been in use for some months with entirely satisfactory results.

The furnace straddles a pit which facilitates the movement of a platform for holding the mold. Constructed of steel after the manner of the pantograph, the platform framework is fastened by iron rods to the front of the furnace at two points, allowing the framework to move freely up and down, but maintaining a constant distance from the crucible lip. This distance may be adjusted to suit the dimensions of the mold used, which may be either conical or of the rectangular bar type.

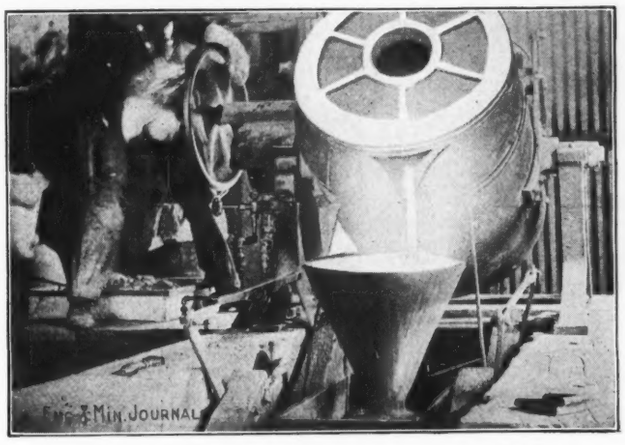
The small platform which directly receives the mold is on rollers, so that it may be placed more or less directly under the crucible lip as desired. This adjustment is of particular advantage when bars are being poured, when

spilling would be costly, although in pouring slag, its advantages are not so marked. The accompanying illustration shows in detail the method of construction. It is understood that since its invention at the Tom Reed mine, the appliance is being manufactured and marketed by a supply firm.

A Conical Bullion Mold

The use of a conical mold for receiving the gold bullion is considered advantageous at the Tom Reed Gold Mines Co., of Oatman, Ariz., for several reasons. One of these is that a bar of almost any size can be made. By melting down as much precipitate as the crucible will hold, skimming and then adding more precipitate until the maximum capacity of the crucible is reached, the final bar is made in one melting. Should the weight be more than would be convenient, two bars can be made instead of one.

Another advantage of the conical form, and one which receives serious consideration, is that the heavy cone of



POURING BULLION INTO THE CONICAL MOLD

gold is inconvenient to handle and presents a considerable obstacle to anyone who might try to purloin it. In fact, so clumsy and elusive is the heavy gold cone that it is almost impossible for any one person to pick it up without the assistance of a sling or appropriate tongs.

The accompanying engraving shows the making of a cone-shaped bar, using a Monarch furnace and the pantograph mold platform already described. This is the first of these platforms to be constructed and is made partly of wood. The later ones are entirely of iron.

Quick Test for Gold in Cyanide Solution

A method for testing cyanide solution for approximate gold content, devised and used by Mr. Dowsett at the Brakpan mill on the Rand, is described by Charles B. Brodigan in *Bull.* 101, I. M. M. The test, which is used particularly on precipitation-press effluent, is as follows:

A sample of 1000 c.c. of cyanide solution is poured into a wide-necked bottle; to this is added three drops of saturated solution of lead acetate; the mixture is then shaken. Add 0.75 gram of zinc dust. Shake again. Add 20 c.c. of saturated cyanide solution and shake for 30 sec. Pour into an evaporating dish and allow dust to settle. Pour off solution, put dish on a spirit lamp, and dissolve zinc dust with about 10 c.c. of aqua regia; boil this until the bulk is reduced to a volume of about 4 c.c. Allow the chloride of lead to settle, and then pour the solution into a test tube. Cool the solution in the tube, and add two drops of a solution of tin chloride. If gold is present to the extent of 0.02 dwt. per ton of the original cyanide solution, a very slight coloration will be perceived in the liquid; 0.03 shows a slight yellow; 0.04 slight pinkish-yellow; 0.06 strong pink; 0.08 the purple of Cassius.

The great advantage of a test of this nature lies in the fact that the shiftman can make it in a few minutes, and he can be certain that precipitation is going on satisfactorily. There is no need to wait for assays to be made.

Steam Pipe Coverings

The loss of heat for bare steam pipes may be taken as 2.7 B.t.u. per hr. per sq.ft. of surface per degree Fahrenheit difference between the temperatures of the steam

COMPARATIVE INSULATING VALUES OF DIFFERENT PIPE COVERINGS

Kind of Covering	Size of pipe, Inches	Thickness of Covering, Inches	Loss in B.t.u. per Square Foot per Hour per Degree Difference of Temperature	Percentage of Heat Lost, Bare Pipe Loss at 100	Authority
Bare pipe			2.7	100	
Mineral wool	8	1.30	0.285	10.6	Brill
Rock wool	8	1.60	0.256	9.5	Brill
a Hair felt	2	0.96	0.387	14.3	Jacobus
b Hair felt	8	0.82	0.422	15.6	Brill
c Remanit	2	1.51	0.302	11.2	Stott
d Remanit	2	1.30	0.363	13.4	Jacobus
e Remanit	2	0.88	0.434	16.1	Jacobus
f Solid cork	2	1.68	0.348	12.9	Stott
f Solid cork	2	1.20	0.427	15.8	Stott
g Magnesia	2	2.41	0.302	11.2	Stott
h Magnesia	10	1.37	0.354	13.1	Barrus
Magnesia	8	1.25	0.384	14.2	Brill
i Magnesia	2	1.16	0.439	16.3	Stott
j Magnesia	4	1.12	0.465	17.2	Norton
Magnesia	2	1.08	0.304	11.3	Jacobus
h Magnesia	2	1.08	0.531	19.7	Barrus
k Asbestos sponge felted	2	1.14	0.260	9.6	Jacobus
k Asbestos sponge felted	10	1.63	0.280	10.4	Barrus
k Asbestos sponge felted	2	1.21	0.490	18.1	Barrus
k Asbestos sponge felted	2	1.24	0.532	19.7	Stott
Manville sectional	8	1.70	0.350	13.0	Brill
l Manville sectional	4	1.25	0.453	16.8	Norton
Manville sectional	2	1.31	0.572	21.2	Paulding
m Asbestos air cell	2	1.26	0.486	18.0	Stott
n Asbestos air cell	4	1.12	0.525	19.4	Norton
n Asbestos air cell	2	0.96	0.716	26.5	Jacobus
n Asbestos air cell	2	1.02	0.793	29.4	Barrus
Asbestos fire felt	8	1.30	0.502	18.6	Brill
Asbestos fire felt	2	1.00	0.721	26.7	Paulding
Asbestos fire felt	2	0.99	0.766	28.4	Jacobus
o Fossil meal	8	0.75	0.879	32.6	Brill
o Riley cement	8	0.75	0.953	35.3	Brill

a A layer of asbestos paper 1.32 in. thick next to the pipe, then the hair felt, then a layer of paper, and outside of all a canvas covering.

b The hair felt bound tightly around the pipe, with no canvas covering; a layer of asbestos paper beneath.

c A covering of two layers wound in reverse direction with ropes of carbonized silk; inner layer 2½ in. wide and ½ in. thick; outer layer 2 in. wide and ¾ in. thick, over which was wound a network of wire; ½-in. asbestos next to pipe.

d A grade known as high-pressure remanit; encased in canvas.

e A grade known as intermediate-pressure remanit; encased in canvas.

f Solid sectional covering of granulated cork with ½-in. asbestos paper next to pipe.

g Carbonate of magnesia, 85%. Average of a number of tests of molded sectionals, thickness of covering ranging from 2.20 to 2.71 inches.

h Carbonate of magnesia with some asbestos fiber; outside finished with canvas.

i Average of tests, thickness of covering ranging from 1.12 to 1.19 inches.

j Molded sectional covering composed of about 90% carbonate of magnesia.

k Laminated sectional, composed of a number of layers of asbestos paper in which were imbedded small pieces of sponge.

l A sectional covering composed of an inner layer of earthly material covered by a layer of wool felt.

m Laminated sectional with ½-in. asbestos paper next to pipe.

n Thin sheets of corrugated asbestos paper, stuck together with silicate of soda.

o Mixed with water and plastered on the pipe.

and the outside air, according to the *Book of Standards* of the National Tube Co. Thus if the pressure of the steam is 120 lb. absolute, the corresponding temperature being 341°, and the temperature of the air 60°, then the loss per hour per foot length from a 4-in. steam pipe,

the external surface of which is 1.178 sq.ft. per ft. of length, will be $1.178 \times (341 - 60) \times 2.7 = 894$ B.t.u. The corresponding condensation can be found by dividing this heat quantity by the latent heat of steam at the given pressure. In the example given, the latent heat of steam at 120 lb. pressure, absolute, is 877.2 B.t.u. Therefore the condensation per hour per foot length of pipe is $894 \div 877.2 = 1.02$ pounds.

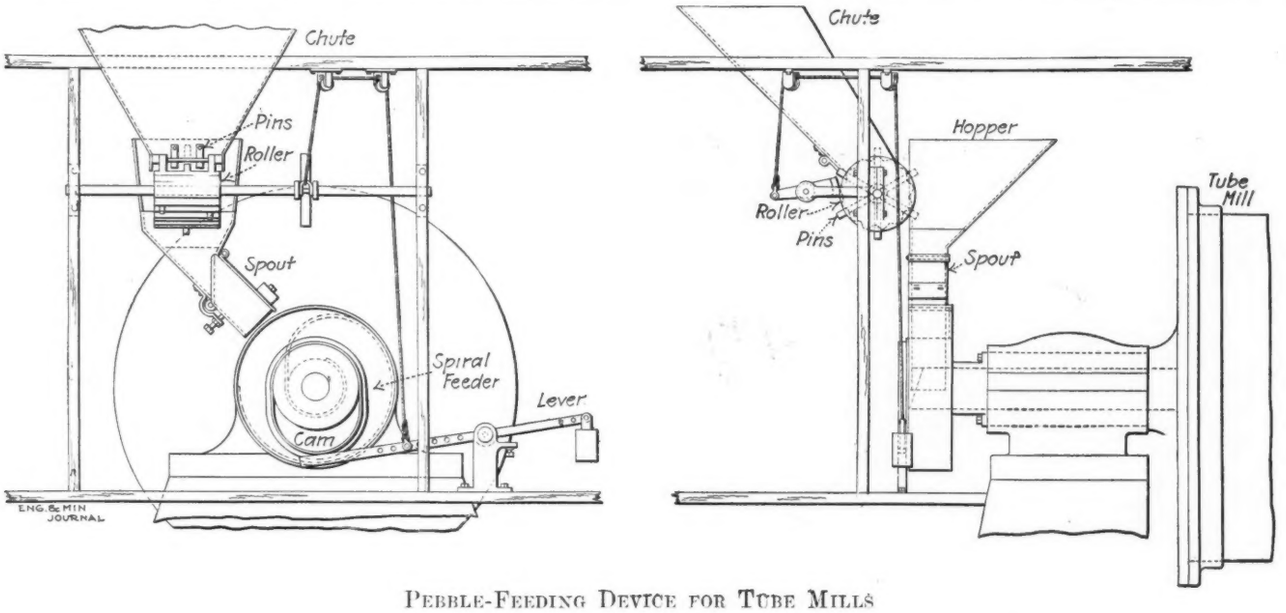
This loss is lessened in practice by covering the steam pipe with a material that will offer a greater resistance to the flow of heat than that offered by the material of the pipe. A good material for the purpose should not suffer serious deterioration from the heat or vibration to which it would be subjected in practice; and in all cases where damage from fire might result, it should never consist of combustible matter. Any covering should be kept perfectly dry, as still water is an excellent carrier of heat. The best insulating substance known is air confined in minute cells and the best nonconducting coverings owe their efficiency to the numerous air cells in their structure. In general the value of a covering is inversely proportioned to its weight, and other things being equal, the incombustible mineral substances are to be preferred to combustible material. No covering should be less than one inch in thickness.

Hair or wool felt and most of the better nonconducting materials have the disadvantage of becoming charred at high temperature and partly losing their insulating power. There is also the danger of taking fire. Mineral wool, a fibrous material made from blast-furnace slag, is the best noncombustible covering, but being brittle it is liable to fall to a powder when subjected to jarring.

Pipe covering may be sectional or plastic. The former is built up in sections and attached to the pipe by bands, which allow easy removal of the covering. The latter is put on in a soft, plastic condition, and is hardened in place; it obviates joints and adheres closely to the pipe. The accompanying table, taken from the various sources noted, gives the results of experiments on steam pipe coverings. In almost all cases the figures given are the averages of a number of tests.

Pebble Feeder for Tube Mills

With the object of feeding pebbles uniformly and continuously into tube mills, J. E. Thomas, of Germiston, Transvaal, has invented a mechanical means for which he has been granted U. S. patent No. 1,045,342. The device comprises a chute which leads the pebbles up to a hopper from which they are discharged into the spiral feeder of the mill. A fluted or corrugated roller delivers the pebbles from the chute into the hopper supplying the mill, and it is provided with projecting pins which protrude through corresponding slots in the hinged bottom of the chute and prevent choking or jamming of the pebbles in the chute. Movement of the shaft upon which the roller is mounted is provided by a friction wheel on the shaft moved by a rope from a lever actuated by means of a cam or eccentric on the casing of the spiral intake. The movement of the lever can be regulated and so made to control the movement of the fluted roll governing the feeding of the pebbles.



PEBBLE-FEEDING DEVICE FOR TUBE MILLS

The pebbles, after entering the hopper, are conveyed through an inclined spout which delivers them directly above the entrance opening of the spiral feeder, into which they fall and are conveyed inside the tube. The movement is so set that the pebbles will be dropped into the intake of the spiral feeder at the proper point of the revolution. By means of this device the chute can be maintained free of pebbles, which will automatically be fed into the tube mill without especial care on the part of the operator. The feeding being continuous, the replacement by new pebbles more nearly approximates the natural rate of wear and avoids the fluctuating efficiency caused by allowing great wear to take place and suddenly replacing it at one time. The accompanying drawings illustrate the arrangement of the mechanism.

The Hardinge Mill

In the JOURNAL of Mar. 29, 1913, in Table III of the article under the above caption, the duty of the 8-ft. Hardinge mill, at Copper Range Consolidated, should be 71 tons, not 7.1 as stated.

THE COST OF DOING THINGS

Ahmeek Mining Co.

During the year ended Dec. 31, 1912, the Ahmeek Mining Co., Lake Superior copper district, Mich., according to its annual report produced its copper for 7.85c. per lb. This cost was made up of: Mining, 5.51c.; construction, 1.2c.; and smelting, freight, refining, etc., 1.14c. per lb. of copper. The cost of mining, transporting rock from mine to mill, stamping and taxes has been as follows: 1909, $1.72 per ton of rock; 1910, $1.42; 1911, $1.42 and in 1912, $1.39 per ton. The rock discarded by hand sorting in the rock house amounted to 2.2% as compared with 1.9% and 3.9% in 1911 and 1910 respectively. These figures do not include poor rock left underground. The following is a summary of the record of the Ahmeek for the past seven years as shown by annual reports:

		Pounds of Refined Copper		Cost, Cents per Lb.	
Year	Tons of Ore Crushed	Per Ton of Ore	Total	Total Cost	Net Cost (a)
1906	166,690	18.5	3,077,507	18.0	.....
1907	320,733	17.4	5,510,985	12.5	.....
1908	298,178	21.1	6,280,241	14.0	13.8
1909	406,045	22.6	9,198,110	15.7	15.5
1910	530,365	22.3	11,844,954	11.06	11.05
1911	598,549	25.4	15,196,127	7.18	7.17
1912	652,260	25.2	16,455,769	7.85	7.69

(a) The net cost per pound represents the cost after deducting receipts from silver sales and miscellaneous sources.

The net result of operations for the seven-year period shows a profit of $2,621,287 of which $1,350,000 has been paid in dividends, beginning in 1911, the remainder has been added to the quick assets of which $1,255,937 were available as cash and copper after paying off all liabilities. The construction paid for during this period and charged in the costs given amounts to $1,571,589 or about 2.33c. per lb. The total cost of copper, not including credits for miscellanetous profits, has averaged 10.8c. per pound.

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Notes on Shaft Sinking and Development

The North Lake Mining Co., Lake Superior copper district, Mich., states in its annual report for 1912 that 63 ft. of shaft was sunk for an average cost of $70.82 per ft. The total cost was made up as follows: mining, $2495.45; timbering, $636.78; concreting, $772.91; power, $677.01; total $4582.15, less a credit of $120.55 for supplies, leaving a net cost of $4461.60. The size of the shaft is not given. The South Lake Mining Co.'s annual report for 1912 gives the cost of a three-compartment shaft at $57.90 90 per ft. for 171 ft. The total cost consisted of $426.35 for cleaning and grading; $606.77 for concreting; $4997.64 for sinking; $2247.04 for timbering; $1724.76 for hoist, boiler and compressor; making a total of $10,002.56. A credit of $110.51 for supplies reduced the total cost to $9892.05. The collar of the shaft is concrete to a depth of 32 ft. A cost of $740.46 is given for the steel shafthouse head frame. At the Indiana Mining Co., in the same district, according to its annual report for 1912, 671 ft. of shaft, sunk from 533 ft. to 1204 ft., cost $50.80 per ft. This cost consisted of the following charges; mining, $15,661.85; timbering, $9641.19; power, $7033.33; three sumps, $1562.25; and sundries, $190.32; a total of $34,088.94. The average cost of 134 ft. of drifts and crosscuts was $7.22 per ft. The 1912 annual report of the Algomah Mining Co., Lake Mine, Mich., states that 1092 ft. of drifting was done for $9.09 per ft., 937 ft. of crosscuts for the same cost and 4415 ft. of diamond drilling for $3.13 per ft. The diamond drilling consisted of drilling No. 6 hole 410 ft. to a total depth of 2538 ft., No. 7 hole to 1533 ft., No. 8 hole to 1772 ft. and No. 9 hole to 700 ft. The Eagle & Blue Bell Mining Co., Utah, in its annual report, states that its No. 1 shaft was sunk 430 ft. to connect with the 1300-ft. level workings at a cost of $20,988.33, this gives a cost of about $48.70 per foot.

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Data on Alaska Treadwell

The following article was compiled from data furnished by Robert A. Kinzie, general superintendent of the Alaska-Treadwell Gold Mining Co., Treadwell, Alaska, and covers a period from May 16, 1910, to Dec. 31, 1911. Men are lowered and hoisted in two cages, running in balance in 1 hr. 10 min. per shift. One cage is engaged in handling supplies the remainder of the time. Heine safety boilers of 200, 230 and 250 hp. are used, working full time under 120 lb. pressure. Fuel oil is used and is consumed at the rate of 11,000 bbl. per month. The length of shift is 10 hr. The rock mined is a hard, altered albite-diorite. All ore during this period was mined by back stoping and amounted to 1,303,338 tons; in addition to this tonnage 45,166 tons were secured from development work, making a total of 1,348,504 tons. Waste hoisted from development amounted to 27,149 tons. The average depth from which ore was hoisted was approximately 1300 ft. An average of 442 men were employed, 314 being engaged in stoping, 58 in development work, 20 in miscellaneous underground work and 50 on the surface at the mine. Of the men engaged in stoping, 220 were engaged in breaking ore, 30 in shoveling ore to chutes and 64 in tramming ore to shafts. The men in development work were divided as follows: Advancing, 36; mucking and tramming, 18; and timbering, 4. The development work during this period consisted of 8465 cu.ft. of stations and pockets and 14,771 linear ft. of development, made up of 147 ft. of shafts, 9296 ft. of drifts and crosscuts, and 5328 ft. of raises.

The dynamite consumption amounted to 2,136,105 lb., 1,915,225 lb. being used in breaking ore in stopes and 220,880 lb. in development work. A total of 1,001,733 ft., b.m., of timber was used in development, general repairs and surface work. In stoping, 37,647 machine-drill shifts were worked and in development 9809 shifts. The consumption of drill steel in both classes of work was 112,920 lb. The following facts may be gathered from the

data given: Approximately 69,200 tons of ore were mined per month. Development work produced one ton of waste for every 1.66 tons of ore taken from development. The total production of ore was equal to about 156 tons per month per man employed underground and on the surface at the mines; 176 tons per month per man underground, and about 233 tons per month per man engaged in stoping. The dynamite consumption in stopes was equal to 1.47 lb. per ton of ore. The total consumption, including that used in development, was 1.59 lb. per ton of ore produced. The timber consumption was equivalent to 1 ft., b.m., for every 1.34 tons of ore produced. The average tonnage in stoping per drill shift was 34.7 tons.

On an average, 1475 machine drills are sharpened per day by machine sharpeners. The forge is fired with fuel oil and air blast is supplied from compressors. It requires 4.5 men 20 hr. to perform this work and six barrels of oil for the forge. In development, 3¼ Ingersoll-Rand drills are used, and it requires 40 min. to set up drills in drifts. The drilling rate is about 33 ft. per 10-hr. shift. In stopes the average drilling rate is 28 ft. About one-fourth of a pint of oil is used per shift for lubricating each machine. Two men loading from a rock bottom into a 4x5-ft. by 1-ft. 5-in. car, and tramming 600 ft. to shaft, will average about 10 cars in eight hours. This is equal to about 18.7 cu.ft. of material per man-hour. Shoveling from a plat under the same conditions they will average 11 cars in eight hours, or about 20.6 cu.ft. of material per man-hour. Loading from a chute and tramming 400 ft. to a shaft, one man will average 30 cars 2.5x4 ft. by 2 ft. 2 in., in eight hours, or 81 cu.ft. per man-hour. Four men on a shift advanced a 7x9.5-ft. drift 160 ft. through diorite in 58 shifts of 10 hr. each, drilling about four hours a shift. This would indicate an average of 4.5 cu.ft. of drift per man-hour, and 45.6 cu.ft. per drilling hour with two machines running. The powder consumption was equal to 0.325 lb. per cu.ft. of drift. Two men raising through slate advanced a 6x7-ft. raise 138 ft. in 43 shifts. of 10 hr. each, drilling seven hours with hammer drills. This is equivalent to approximately 6.74 cu.ft. of raise per man-hour. Timbering required about 20 hr. and powder consumption was equal to about 0.276 lb. per cu.ft. of raise. In sinking a 7x8-ft. shaft through blocky greenstone, five men per shift sunk 42 ft. in 60 shifts of 10 hr. each, drilling three hours per shift. This gives an average of 1.76 cu.ft. per man-hour. The powder consumption was about 0.142 lb. per cu.ft. of rock.

Mining Cost at Bodie, Calif.

The yearly report of the Standard Consolidated Mining Co., of Bodie, Calif., gives a detailed account of the mining cost. A total of 8150.38 tons were mined and the total cost was $10.718 per ton. In detailing these costs, under development is noted: Labor, $3.70; lumber, 0.323; explosives, 0.284; candles, 0.055; and other supplies, 0.030; a total of $4.39. Distributed accounts charged to development are: Stable, $0.161; yard, 0.033; power plant, 0.067; assay office, 0.098; blacksmith shop, 0.102; and machine shop, 0.003; total $0.464. This makes a total development cost $4.857.

Stoping is divided into labor, $4.335; lumber, 0.429; explosives, 0.388; candles, 0.075; supplies, 0.033; and ore purchased, 0.057; total $5.317. The distributed accounts to stoping are: Stable, $0.188; yard, 0.039; power plant, 0.078; assay office, 0.113; blacksmith shop, 0.122; and machine shop, 0.004; total, $0.544, an entire cost for stoping of $5.861 per ton, and combined cost of all mining items, $10.718 per ton.

Quincy Mining Co.

The annual report of the Quincy Mining Co., Hancock, Mich., for the year ended Dec. 31, 1912, states that the production of fine copper amounted to 20,634,800 lb. The total expenditures during the year amounted to $2,586,053, of which $150,000 was expended on land purchases and $110,049 on construction. The total cost per pound of copper for all expenditures was as follows: Mining, 8.62c.; opening mine, 1.29c.; Michigan taxes, 0.31c.; smelting, transportation, etc., 0.88c.; construction, 0.535c.; accident account, 0.165c.; and land purchase, 0.73c. per lb. of copper, making a total of 12.53c. Deducting receipts from silver sales and miscellaneous receipts, the net cost was about 12.3c. per lb. The tonnage sent from the mines to mill amounted to 1,309,253 tons, indicating an average yield of 15.8 lb. per ton. The net cost per pound of copper after deducting all miscellaneous receipts has been as follows: 1906, 11.9c.; 1907, 12.2c.; 1908, 11c.; 1909, 10.3c.; 1910, 10.3c.; 1911, 10.5c., and in 1912, 12.3c. The average price received has been: 19.5c., 18.8c., 13.5c., 13.45c., 13.2c., 12.8c. and 16.5c., respectively, for the years 1906 to 1912, inclusive. The production of the Quincy up to the end of 1912 has been approximately 500,000,000 lb. of copper, from which it has been paid $20,430,000 in dividends, or about 4c. per lb. The production for the last seven years amounts to 144,507,998 lb., with dividends of $5,210,000, or about 3.6c. per lb. of copper.

Copper Queen Power Plant

A full description of the Copper Queen smeltery power plant is given in the JOURNAL of Apr. 12, 1913. The following details of cost are taken from the annual report. In 1912, there were 3.99975 gal. of oil used per ton of ore mined, evaporation was figured at 15.68 lb. of water from and at 212° per gal. of oil burned, and the efficiency of the boiler plant was figured at 81.7%. There were 119,831 bbl. of oil burned at the main boiler plant, and 53,165 bbl. burned at the reverberatories, of which 48.85% was charged to steam and credited to reverberatory operations. The cost per horsepower-year was figured at $55,12, the power being used by the smelter being $58.92 and that from the turbo-generator $38.26.

Phelps-Dodge Concentrators

During 1912 the Detroit Copper Mining Co.'s concentrator treated 501,928 tons of 3.08% Cu ore, and produced 70,438 tons of 16.69% concentrates. The tailings assay was 0.811%. The saving, as figured in four different ways, averaged 76.99%. Water used per ton of ore milled, was 511.2 gal. Running time was 95.11% of the total time.

At the Moctezuma concentrator there were 596,600 tons of 3.494% Cu ore milled, and 131,062 tons of 13.373% concentrates produced. The tailings carried 0.59% Cu. The saving was 85.95% and fresh water per ton of ore milled was 799 gallons.

Ore Occurrence at Prince Consolidated

By Edward R. Zalinski*

SYNOPSIS—The orebodies in the Prince Consolidated mine at Pioche, Nev., occur in three different forms: (1) Large replacement bodies in limestone—iron-manganese ore, low in silver and lead, chiefly valuable for fluxing; (2) bedded deposits in the shale—higher grade somewhat siliceous, silver-lead ore; (3) vein filling in the mineralizing fissures of the lower levels—siliceous and still higher in silver and lead.

The Prince mine is situated on the southwest slope of the Pioche Mountains, in the Ely mining district, Lincoln County, Nev. The claims lie three miles southwest of the town of Pioche. Construction was started in February of last year on a railroad branch to connect the mine with the San Pedro R.R. This branch was completed in August. It is 8¾ miles long with a maximum grade of 2% and runs from Pioche westerly around the north side of the Pioche range, circling the northwest end, and running southeast down the southern side to the Prince Consolidated mine. Fig. 3 shows grading on this road with plough and scrapers.

In an air line the property is a mile and a half across the range from the well known mines of the camp, the Raymond & Ely, Meadow Valley, and others which produced high-grade silver ores in the early days from fissure veins in the quartzite. The veins were strong in the quartzite, and became weaker in passing into the overlying shales. They were worked extensively above the water level (1200 ft. at Pioche). The ores were largely oxidized, though they carried sulphides of lead and zinc, with silver and some gold. The gangue material was quartz.

Surface Equipment

The Prince shaft and buildings are in the foothills of the range at an altitude of 6000 ft. The ground slopes to the south with rolling sage-brush ridges down to the Panaca Valley wash. Fig. 1 shows the Prince camp and dumps, with the headframe of the main shaft in the center background. The mine buildings consist of an office, boarding house, hoist and compressor building, blacksmith shop, ore bins, and houses for the employees. Water is obtained from the Nevada-Utah pipe line from springs in the Highland range 7½ miles distant.

The equipment consists of a 50-hp. Fairbanks-Morse hoist, handling a 1-ton skip and an Ottumwa 100-hp. hoist, operating by compressed air and handling a 2-ton skip. These hoists are interchangeable and are both used for hoisting from the main inclined shaft over the same headframe. An Ingersoll-Rand Imperial, Type-10 compressor having a capacity of 707 cu.ft. of free air per min. is driven by a 100-hp. Fairbanks-Morse, double-cylinder vertical-type engine. A smaller compressor is driven by the 50-hp. hoist.

Fig. 1. General View of Prince Consolidated Property

Fig. 2. Surface Equipment and Outcrop

Fig. 3. Grading for Railroad Branch

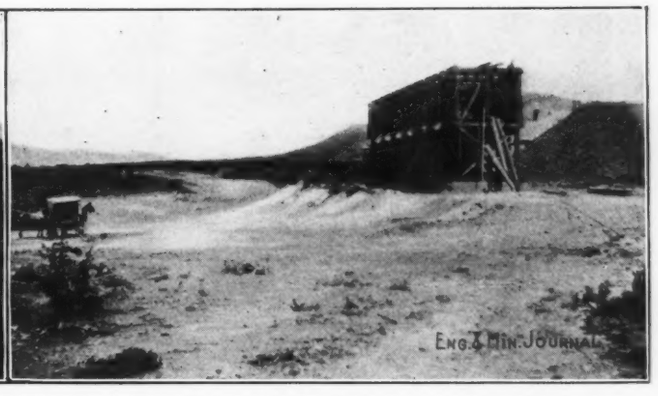

Fig. 4. New 750-Ton Orebins

*Mining engineer, 319 Newhouse Bldg., Salt Lake City, Utah.

There is a cooling tower which enables the 100-hp. engine to be kept cool on 400 gal. of water with little water loss. This tower is 30 ft. high by 3 ft. square, and is covered with ⅛-in. copper screen. Water is pumped into a square sheet-metal tank about six inches deep at the top, and overflows through perforations down the screens in a thin sheet. The exhaust from the hoist escapes through the center of the tower, and aids in the cooling. Fig. 5 shows the tower in operation, with details of construction.

Country Rocks Are Limestone and Shale

The country rocks are limestone and shale. The surface is rounded and largely covered with wash. There are a few prominent outcrops, though in the foothills limestone is exposed in place. The limestone contains interbedded shale of small thickness and is underlain by thicker shale beds. The geological section at Pioche from older to younger consists of Cambrian quartzite 1500 ft. thick, followed by shale, 400 ft.; limestone, 600 ft. or over; shale, 75 ft.; and limestone, 800 ft. more or less eroded.[1]

There has been strong fissuring and faulting with upthrows in some cases of several hundred feet. A small bed of shale outcrops between two faults known as the Gladstone and Prince faults. It extends in a northwesterly direction between these fissures and cannot be traced beyond, being cut off abruptly at both points. The Gladstone fault, a quarter of a mile north of the Prince, strikes N 75° E (magnetic), and dips steeply to the north. The Prince fault, south of the main workings, strikes northwest, and dips 54° to the southwest. The block of ground a quarter to half a mile or more in width between the two faults has been thrust up several hundred feet relative to the adjoining ground. It is in this block that the orebodies of the Prince occur. Shale was cut by the Prince shaft at 240 ft. This belongs to the 400-ft. beds, and does not outcrop. In adjoining properties, this shale is 600 ft. or more beneath the surface.

Rhyolite Dikes Found

There are dikes of rhyolite porphyry in the neighborhood, which cut the limestone and shale. One of these is exposed at the Golden Prince shaft, northwest of the Prince, and is six or eight feet thick. Rhyolite has been opened on the East Prince claims about a mile from the Prince. A shaft 200 ft. deep was sunk in this rock, which is of a reddish to light-brown color. It carries phenocrystals of quartz and feldspar, the former in dihexahedral crystals. This rhyolite incloses angular fragments of an older, gray rhyolite or andesite, and of green shale, through which it broke its way. The extent or form of the rhyolite here is not known.

While the igneous rocks in this neighborhood may have had more or less influence on the ore deposition at the Prince; as far as observed underground, they are nowhere intimately or directly associated with the deposits.

Extensive Fissuring and Faulting Exist

There has been strong fissuring and faulting, before, during, and after ore deposition. The strongest fissures strike northwest, approximately parallel to the Pioche Range, and in most cases dip steeply to the northeast toward the range, though south dipping fissures also occur. Other fissures trend northeast and north and south. Mineralization accompanied the northwest fissuring and the limestone on the surface is often stained black with iron and manganese along the strike. The ore replaced certain beds in the shale, and in the limestone along these fissures. In the latter it spread out some distance from the fissures, forming a broad ore-zone from 110 up to 150 ft. wide.

Northwest and east-west post-mineral fissuring occurred. On the northwest and east-west faults, the northeast and north sides usually drop. The displacements in most cases are small. Some of the fissures are roughly parallel to the trend of the ore, and dip to the southwest. The No. 1 and No. 2 mineral-bearing fissures on the lower levels strike northwest and dip steeply to the northeast. They apex in the large body of iron and manganese ore above the 200 level.

Three Types of Orebodies

The orebodies in the Prince mine occur in three forms or types of deposits: (1) As large replacement bodies in the limestone; (2) as bedded deposits in the shale; (3) as vein filling in the mineralizing fissures.

The ores are all oxidized with the exception of irregular bunches and streaks of galena in otherwise oxidized material. The ore in the large replacement body is low in silver and lead, but carries a large excess of iron and manganese. The ore in the fissure veins is relatively high in lead and silver, but carries an excess of silica. The ore beds in the shale are of an intermediate character between the two, due to the nature of the shale, which carries some original silica, and has been more or less replaced by ore.

Replacement Body in Limestone Is Extensive

The principal orebody replaces the bottom beds of the 600-ft. limestone series along the contact with shale. Shale forms the footwall. This body has been opened for more than 400 ft. northwest and southeast along the mineralizing fissures and for 110 ft. to 150 ft. in width. It outcrops near the Prince shaft in the form of a wedge from 50 to 150 ft. wide, the small end or point of the wedge being northwest of the shaft, and gradually widening toward the southeast. Fig. 2 shows the outcrop of this ore from the rocks in the foreground to the small building back of the trestle in the center.

This body was cut for 242 ft. in the shaft. The limits have not been fully determined. In a general way, it conforms to the strike and dip of the beds, dipping 16° or 18° to the southeast, but in places cuts across them, dipping 30° or steeper to the west.

The ore minerals are largely iron and manganese oxides with varying amounts of galena, lead carbonate and silver chloride. Spar and quartz are present as gangue minerals scattered through the iron and manganese, the former in notable quantity along the edges or borders of the ore. Typical ore of this character carries around 3 oz. in silver and 4% lead, with from 30 to 40% excess iron. This makes a desirable flux, and a large part of the payment made by the smelters is for the excess of iron, manganese and lime.

While a series of northwest fissures is responsible for this body, there are a number of northeast and north-

[1] "Geology of Pioche, Nevada and Vicinity," by F. J. Pack, "School of Mines Quarterly," April and July, 1906, p. 294.

south open fissures crossing it, along which the ore is more siliceous and carries kidneys of galena with silver chloride and occasionally a small amount of copper stain. The richer ore near these fissures suggests that they may be responsible for a later period of mineralization and enrichment of the original low-grade iron and manganese deposits.

Several Bedded Deposits in the Shale

The lime-shale beds on the 300-ft. level strike nearly north and south and dip 17° to the east. Some of these beds have been replaced by ore from the main fissures. There is a 5-ft. ore bed and a 12-ft. ore bed which have been followed some distance on the strike and dip; also a 6-ft. bed and an 8-ft. bed between the two principal mineral-bearing fissures. The shale beds are entirely separate from the manganese bodies, and show the influence of the somewhat siliceous country rock in the character of the ore.

The 5-ft. ore bed has been opened on the 300-ft. level and below from the 400 and 550 by a number of raises.

The Ore-bearing Fissures

Two principal ore-bearing fissures have been opened on the lower levels. The No. 1 fissure carries lead carbonate ore running well in silver. This fissure is one to five feet between walls. The north or hanging-wall side drops, displacing the ore beds 7 ft. at one point and 15 ft. at another, as shown by corresponding beds on the hanging and foot. The No. 2 fissure on the 300 level carries fine-grained steel galena and lead carbonate, replacing the lime-shale in and along the fissure. At some points the lead carbonate ore replaced the shale, retaining its color and structure in the smallest details.

To all appearances the rock is normal shale, except for the weight, though in other cases the replaced material has more of a grayish color. Movement occurred during ore deposition, as shown by fragments of replaced shale-carbonate ore inclosed in ore subsequently deposited.

Ore makes on certain shale beds between the No. 1 and No. 2 fissures. There is a 6-ft. and an 8-ft. bed of

Fig. 5. Water-Cooling Tower

Fig. 6. Main Headframe and Surface Plant

The beds on the 400 strike northeast and dip 14° to 18° southeast. They are cut by east-west faults on which the north side drops with small displacement, the ore having been picked up again within a few feet.

The 5-ft. ore bed is about 100 ft. above or at a higher horizon than the 12-ft. ore bed. These beds were either more calcareous and susceptible to replacement than the adjoining shale beds or were crushed or fractured, which allowed a freer circulation of the mineral solutions in them, causing them to be replaced by ore. This character of ore in the 5-ft. bed carries up to 6% lead, 8 oz. silver, and $1.00 in gold, with an excess of iron.

Beside the beds in the shale mentioned, there is also a 30-ft. bed of manganese ore, a bed of manganese ore four or five feet thick, and a 20-ft. bed of manganese ore replacing beds in the shale, but resembling in character the large body of iron and manganese, though they are more siliceous in places. Some of these beds in the shale carry a large amount of spar.

ore. Both fissures apex in the large body of iron and manganese, and were probably in part responsible for this orebody.

Six Levels Opened from Inclined Shaft

The main shaft is 600 ft. deep, and is inclined 63° to 65°. It starts in iron-manganese ore and is in this for 240 ft.; after this brown to greenish lime-shale was cut for 50 ft.; then a 30-ft. bed of iron-manganese and spar; then lime-shale to the 400 level; a bed of manganese ore four or five feet thick; 80 ft. of shale; manganese ore 22 ft. thick, with the remainder of the shaft in shale to the bottom. Fig. 6 shows the main shaft and headframe, blacksmith shop, and hoist house.

Levels have been driven at the 100-, 200-, 240-, 300-, 400-, and 550-ft. points to develop the large orebody and ore in the shale beds and fissures. There is also an old shaft and open-cuts and trenches made by the old-timers in search of the richer pockets and kidneys of galena in

the iron-manganese formation. A winze was sunk on the No. 1 fissure from the 550 level, and cut what was thought to be the underlying quartzite at a depth of about 50 ft. Recent diamond-drilling in this neighborhood has proved this to be a thin bed of quartzite with shale below it. Pyritic ore carrying silver with some gold has been cut. In Fig. 7 is shown the relative position of the different orebodies.

The ore is solid and easily mined. Before machine drills were used, one man broke 35 tons in a shift, as stated by Supt. William Lloyd. There are occasional limestone or shale horses, but the limits of these are clearly marked, and in general there is little waste mixed with the ore, the limestone having been thoroughly replaced by iron and manganese.

Caving Abandoned for Shrinkage Systems

In May, 1912, the large orebody was being opened up and preparations were being made to mine it by caving. Crosscuts were driven on alternate sides of the main drifts on the 200- and 240-ft. levels, about 20 ft. apart. A series of raises was driven from the 240 level, sloping 50° and having numerous subraises or branches, up to and a little above the 200. It was expected to drive raises along the hanging and foot walls to loosen the ore along the walls. After the blocking out or honeycombing by the raises was accomplished, the pillars above the second level were to be blasted, allowing the entire mass to cave and be drawn off on the 240-ft level. This plan was subsequently changed, its being deemed advisable to mine by the shrinkage or filling system. A pillar 40 ft. thick was left in the center of the orebody, and two stopes about 40 ft. wide were started on each side of the pillar. These stopes are kept full of broken ore, and only sufficient rock is drawn out so that the men can work from the top. After the two stopes have been carried up to the hanging wall, it is the intention so to weaken the 40-ft. pillar that it will crush and can be drawn off with the broken ore from the stopes.

In the 30-ft. bed, rooms 20 to 30 ft. wide are to be driven leaving a pillar of about the same thickness. These pillars are to be mined by the use of temporary stulls, as many of these as possible being recovered, allowing the hanging wall to cave. The narrow beds in the shale are to be worked in a similar way.

New ore bins approximately 75 ft. long by 14 ft. wide by 12 ft. deep, having a capacity of 750 tons were built at the time of the completion of the railroad. These are shown in course of construction in Fig. 4. About 350 tons of ore a day is being mined at present.

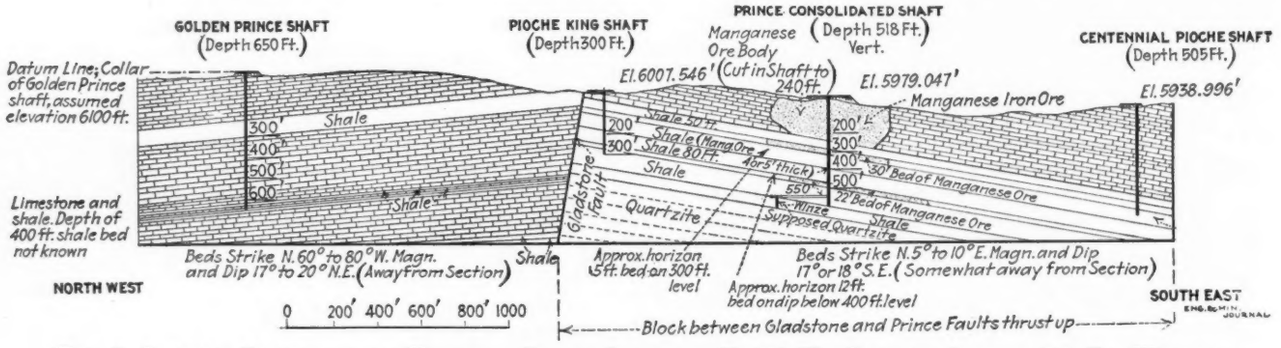
GOLDEN PRINCE SHAFT (Depth 650 Ft.)
PIOCHE KING SHAFT (Depth 300 Ft.)
PRINCE CONSOLIDATED SHAFT (Depth 518 Ft. Vert.)
CENTENNIAL PIOCHE SHAFT (Depth 505 Ft.)
Manganese Ore Body
Datum Line; Collar of Golden Prince shaft, assumed elevation 6100 ft.
El. 6007.546' (Cut in Shaft to 240 ft.
El. 5979.047'
El. 5938.996'
Manganese Iron Ore
Shale
Shale 50 ft.
Shale (Mang. Ore 4 or 5' thick)
Shale 30 ft.
30' Bed of Manganese Ore
22' Bed of Manganese Ore
Limestone and shale. Depth of 400 ft. shale bed not known
Gladstone Fault
Quartzite
Winze
Supposed Quartzite
Beds Strike N. 60° to 80° W. Magn. and Dip 17° to 20° N.E. (Away From Section)
Approx. horizon 5 ft. bed on 300 ft. level
Approx. horizon 12 ft. bed on dip below 400 ft. level
Beds Strike N. 5° to 10° E. Magn. and Dip 17° or 18° S.E. (Somewhat away from Section)
NORTH WEST
SOUTH EAST
0 200' 400' 600' 800' 1000
Block between Gladstone and Prince Faults thrust up

Fig. 7. Section Projected on Vertical Plane Striking N 43° W. Section Passes 400 Ft. West of Golden Prince Shaft and 360 Ft. East of Prince Workings

Standard Consolidated Mining Co.

The Standard Consolidated Mining Co., of California, produced 8150 tons of ore in 1912, with an average value of $11.72 per ton. In addition to this ore from the mine, the cyanide plant treated 16,596 tons of tailing from old slime ponds; the total realization from the 24,719 tons treated was $188,902. The tailing re-treated had an average value of $5.63 per ton. The cost of mining has been decreased from $12.67 in 1911 to $10.72 in 1912.

During the year, 6216 ft. of development work was done at a cost of $6.37 per ft., or $4.86 per ton. Stoping, in 20 different veins, cost $5.86 per foot.

After the slime ponds are exhausted, which will be next year, the mine tonnage will have to be doubled to keep the mill and cyanide plant running. At present the reserve consists of 1800 tons of ore, valued at $32,000, but development work is being pushed.

The cost for milling was $1.92 per ton and for cyaniding, $2.10 per ton treated.

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Cinnabar Discovery in Dutch Guiana

By David E. Headley*

A discovery of cinnabar has been made on the Maroni River, in Dutch Guiana. A few years ago, A. J. Wittage, while washing for gold at Boni Doro on this river, discovered several waterworn specimens of cinnabar. He himself failed to recognize them, and they were rejected as worthless by an engineer to whom they were submitted. However, the discovery became rather widely known, and the stones were seen by different people, so that in May or June, 1911, J. Robles obtained a concession covering the former claims which had been abandoned. The scene of the discovery is about 2½ days' journey by boat from the town of Albina. In August, 1911, I visited the district and from placer workers received several specimens of the cinnabar pebbles. On a second visit in August, 1912, I devoted some time to exploration and found similar pebbles in large boulders of conglomerate. Prospecting up the stream I found other boulders on the mountainside near what appeared to be the outcrop of the material in place. The deposit covers apparently a considerable area. It has been examined by an American and a Dutch engineer, although the results of their findings have not been made public. The pebbles show a beautiful crystalline structure, and are exceedingly pure.

*Albina, Dutch Guiana.

Freight Rates Reduced on Kansas Petroleum Residuum

WASHINGTON CORRESPONDENCE

In a decision just handed down by the Interstate Commerce Commission in the case of the Central Commercial Co. vs. the Atchison, Topeka & Santa Fé Ry. Co., the rate of 33.1c. per 100 lb. for the transportation of petroleum residuum, or road oil in tank cars from the Coffeyville, Kansas, field to points in Nebraska, is found unreasonable and reduced to 21c. This affects practically all oil from the Kansas field. The rates that have been in effect are shown in the table.

FORMER FREIGHT RATES ON OIL FROM KANSAS TO NEBRASKA

		Petroleum		Residuum or Road Oil	
To Hastings From	Distance, Miles	Rate in Cents per 100 Pounds	Mills per Ton-mile	Rate in Cents per 100 Pounds	Mills per Ton-mile
Coffeyville, Kan.....	480	33.1	13.8	33.1	13.8
Wood River, Ill.....	581	37.5	12.9	21	7.23
Whiting, Ind.....	639	42.5	13.3	23.5	7.34
Robinson, Ill.....	712	43.95	12.4	27	7.59
Sugar Creek, Mo.....	318	28	17.6	28	17.6

With reference to the situation in general the Commission holds that "a fair average price for this commodity is from 1½c. to 3c. per gal., while the refined oils and other high-grade products are worth two or three times as much. The price of crude oil or crude petroleum affects the prices of the products, but the relation of values between the products remains the same whatever the price of crude oil. The value is not necessarily controlling, but this article is essentially a byproduct or refuse from a manufactured article and without question is of materially less value than the refined or other high-grade products of petroleum."

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The Fluorspar Industry

The large output made in 1912 by the Fairview and Rosiclare mines of the Illinois-Kentucky district, has enabled the operators of those properties practically to control the market. Naturally with plenty of production they are not inclined to let any order get away from them. Consequently, fixed prices over a long period of time have not been the rule.

During the latter part of 1912 and up to the close of the first quarter of 1913, most of the fluxing fluorspar, lump and gravel, sold in Kentucky has gone at $5.50 per ton. During the last 10 days, since the Illinois mines were flooded, fluxing fluorspar has been in better demand, and better prices have been offered and taken. Recently one lot of fluxing fluorspar sold for $7 per ton; another lot for $7.50; another lot of considerable size is offered at $6.75. Comparing these figures with an observation that a 1000-ton lot was offered about the middle of March at $5.25 and refused, and the same lot being temporarily withdrawn from the market, the present average price for gravel fluorspar may be appraised at about $6.75@7, with prospect of a price of $7.50 if the market continues firm.

Ground fluorspar is sold to two branches of trade. High-grade acid spar is bought by the trade in three different forms; already ground; in the form of choice, selected lump; and in thoroughly jigged, coarse, dried mill concentrates. High-grade acid lump and coarse mill concentrates have been bringing $8@10 during the last six months; the price depending upon buyers' representatives coming to the district, scouting for, and bidding on such product. Apropos, choice lump fluorspar from southern Illinois was offered around $12, all through last year.

Ground fluorspar suitable for the acid grade, is offered at Marion, Kentucky, at $12.50 in bulk; $14.25 in bags; and $15 in barrels. Ground spar suitable for the enamel and glass trade is offered at $11@11.50. However, the Illinois mines are believed to have sold ground fluorspar lately (before the inundation) lower than these prices.

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Goldfield Consolidated Costs

The Goldfield Consolidated Mines Co. submitted a report to its stockholders for the 14 months ended Dec. 31, 1912, in which details of production and cost are given.

There were 403,360 tons milled having an average value of $19.74 per ton, and 12,426 tons shipped, averaging $20.71 per ton. The loss in tailing was $1.36 per ton, leaving a recovery of $18.41 per ton.

Total operating costs are given as $5.53 per ton, which includes: Mining 415,786 tons; labor, $2.34; supplies, 0.89; and power, 0.16; total $3.39. Transportation expense for 403,360 tons was, operation, $0.06 and maintenance 0.03, a total of $0.09 per ton moved. Milling 403,360 tons cost for labor, $0.39; supplies 0.94, and for power, $0.33; total, $1.66. The cost for concentrate treatment, distributed over the total tonnage milled, was labor, $0.07 per ton; supplies, $0.27; and power, $0.05 per ton, a total of $0.39 per ton.

Cost of concentrate treatment per ton of concentrate, 24,376 tons treated, was: Labor, $1.24; supplies, $4.50; power, $0.76, and total $6.50 per ton.

The production value stated does not include any estimation of the value of copper in the ore shipped. This income amounted to $83,765, and has been considered an offset to the cost of marketing ore. The amount received for copper amounts to $0.20 per ton on the total number of tons mined, and by adding this to production it would make a corresponding addition to total costs.

Total costs are given as $6.72 per ton, which includes operating expense, marketing, general expense, taxes and construction. Considering the additional $0.20 per ton received for copper, which has been deducted from expense, a total of $6.92 would be obtained

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Victoria Copper Mining Co.

The report of the Victoria Copper Mining Co., of Victoria, Mich., for the year ending Dec. 31, 1912, shows that the surplus has been reduced $36,421, owing to several unavoidable expenditures. Some of these items are: Settlement of judgment in the Rich suit; expenditure for insurance of employees and construction of additional houses for employees. The latter was necessary in order to improve labor conditions at the mines, which have previously interfered seriously with operations.

The production of copper for the year was 1,224,911 lb., valued at $202,168, and there were miscellaneous earnings amounting to $11,597, a total of $213,766 for income. The costs included working expenses at the mines, $190,644, and for smelting, freight, cost of marketing, etc., expenses amounting to $22,693, a total of $213,337. This leaves a profit of $428 for the year. Total receipts of the company from its organization have been $2,686,257, and expenditures, $2,658,633, leaving a balance of expenditures over receipts of $27,623.

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TESTS OF STRUCTURAL TIMBERS. By McGarvey Cline and A. L. Heim. Pp. 123, illus. Forest Service Bull. 108, U. S. Department of Agriculture, Washington, D. C.

RAILWAY ROUTES IN ALASKA. Message from the President of the United States Transmitting Report of Alaska Railroad Commission. Pp. 172, illus. Document No. 1346, House of Representatives, Washington, D. C.

THE CLASSIFICATION OF PUBLIC LANDS. By George Otis Smith. Pp. 197. Bull. 537, U. S. Geological Survey, Washington, D. C.

RADIOAKTIVE WAESSER IN SACHSEN. Part 4. By M. Weidig. 7x10, pp. 139, illus., paper; 6 Marks. Craz & Gerlach, Freiberg in Sachsen, Germany.

COAL, AND THE PREVENTION OF EXPLOSIONS AND FIRES IN MINES. By John Harger. 5½x8¾, pp. 183; $1.25. Longmans, Green & Co., London.

THE UNDERGROUND WATERS OF SOUTHWESTERN OHIO. By M. L. Fuller and F. G. Clapp. Pp. 228, illus. Water-Supply Paper 259, U. S. Geological Survey, Washington, D. C.

GEOLOGY AND WATER RESOURCES OF A PORTION OF SOUTH-CENTRAL WASHINGTON. By Gerald A. Waring. Pp. 46, illus. Water-Supply Paper 316, U. S. Geological Survey, Washington, D. C.

GAZETTEER OF SURFACE WATERS OF CALIFORNIA. Part III, Pacific Coast and Great Basin Streams. B. D. Wood. Pp. 244. Water-Supply Paper 297, U. S. Geological Survey, Washington, D. C.

WATER POWERS OF THE CASCADE RANGE. Part II, Cowlitz, Nisqually, Puyallup, White Green, and Cedar Drainage Basins. By Fred F. Henshaw and Glenn L. Parker. Pp. 170, illus. Water-Supply Paper 313, U. S. Geological Survey, Washington, D. C.

WATER RESOURCES OF CALIFORNIA. Part III, Stream Measurements in the Great Basin and Pacific Coast River Basins. By. H. D. McGlashan and H. J. Dean. Pp. 956, illus. Water-Supply Paper 300, U. S. Geological Survey, Washington, D. C.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part I, North Atlantic Coast. By C. C. Babb, C. C. Covert and R. H. Bolster. Pp. 221, illus. (Water-Supply Paper 301); Part III, Ohio River Basin. By A. H. Horton, M. R. Hall and H. J. Jackson. Pp. 158, illus. (Water-Supply Paper 283); Part XI, Pacific Coast in California. By H. D. McGlashan and R. H. Bolster. Pp. 304, illus. (Water-Supply Paper 311), U. S. Geological Survey, Washington, D. C.

MONTANA STATE INSPECTOR OF MINES, BIENNIAL REPORT FOR 1911-1912. Pp. 128. William Walsh, Inspector, Helena, Mont.

MINERAL RESOURCES OF THE UNITED STATES. 1911. Part I, Metals, Part II, Nonmetals. Pp. 1018 + 1224. U. S. Geological Survey, Washington, D. C.

AN EXTENSION OF THE DEWEY DECIMAL SYSTEM OF CLASSIFICATION APPLIED TO THE ENGINEERING NDUSTRIES. By L. P. Breckenridge and G. A. Goodenough. Pp. 117. Bull. 9 (Revised), University of Illinois, Urbana.

GOLD, SILVER, COPPER, LEAD AND ZINC IN THE WESTERN STATES AND ALASKA IN 1911. MINE PRODUCTION. By A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey and C. G. Yale. Pp. 791. Advance Chapter from Mineral Resources of the U. S. Geological Survey, Washington, D. C.

COAL FIELDS OF GRAND MESA AND THE WEST ELK MOUNTAINS, COLORADO. By Willis T. Lee. Pp. 237, illus. Bull. 510, U. S. Geological Survey, Washington, D. C.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part XI, Pacific Coast in California. By H. D. McGlashan and R. H. Bolster. Pp. 304, illus. Water-Supply Paper 311, U. S. Geological Survey, Washington, D. C.

THE COMMERCIAL MARBLES OF WESTERN VERMONT. By Nelson Dale. Pp. 170, illus. Bull. 521, U. S. Geological Survey, Washington, D. C.

ATOMPROZENTE UND GEWICHTSPROZENTE SOWIE DIE METHODEN ZU IHRER GEGENSEITIGEN UMWANDLUNG. By Fritz Hoffman. 7¾x11¼, pp. 27, illus.; 1.80 marks. Wilhelm Knapp, Halle, a. S., Germany.

JOURNAL OF THE IRON AND STEEL INSTITUTE, VOL. LXXXVI. Edited by George C. Lloyd, Secretary, 5½x8½, pp. 708, illus. Published at the offices of the Institute, London, Eng.

PEAT DEPOSITS OF OHIO: THEIR ORIGIN, FORMATION AND USES. By Alfred Dachnowski. Pp. 424, illus. Fourth Series, Bull. 16, Geological Survey of Ohio, Columbus.

DIE ELEKTROLYTISCHE ALKALICHLORIDZERLEGUNG MIT FESTEN KATHODENMETALLEN. Part II, Beschreibung ausgefuhrter Anlagen usw. By Jean Billiter. 6¾x9¾, pp. 182, illus., paper; 9.60 marks. Wilhelm Knapp, Halle a. S., Germany.

PYRITES IN CANADA; ITS OCCURRENCE, EXPLOITATION, DRESSING AND USES. By Alfred W. G. Wilson, 6¾x10, pp. 197, illus. Canada Department of Mines, Mines Branch, 1912, Ottawa.

This publication by the Department of Mines of Canada is another example of the excellent, thorough-going manner in which its reports are issued. The pyrite deposits of the Dominion are described in detail and the possibility of applying pyrite to the generation of sulphur dioxide for the paper industry is discussed at some length. Incidental to these points are descriptions of roasting furnaces, the manufacture of sulphuric acid, the mining and marketing of pyrite, together with its uses and the uses of sulphur. The written material is excellently supplemented with halftone illustrations, line drawings, tables and maps.

COAL: ITS COMPOSITION, ANALYSIS, UTILIZATION AND VALUATION. By E. E. Somermeier. 6¼x9¼; pp. 175; illus.; $2, net. McGraw-Hill Book Co., New York.

It is stated in the preface of this book that it has been the aim of the author to suit three distinct classes of readers: The mechanical and power-plant engineer; the chemical engineer and chemist; the nontechnical business man and operator, who has to do with buying and selling coal. The book is divided as follows: Composition and heating value; coal analyses; sampling; methods of analysis; determination of calorific value; improvement of coal by washing; purchase of coal under specification; flue-gas analysis. One may wonder exactly why the last is included, but in general, considering the wide range of readers which the author attempts to satisfy, and the great variation in treatment required, the results are very commendable.

AMERICAN MINE ACCOUNTING. By W. H. Charlton. 6x9¼, pp. 367, illus.; $5. McGraw-Hill Book Co., New York.

This book contains detailed descriptions of the accounting systems of the Oliver Iron Mining Co.; the Ojibway Mining Co., both mining and milling; Utah Consolidated; Calumet & Arizona smeltery; Utah Fuel Co., coal mining and coke making; Portland Gold Mining Co., mining and milling. To an accountant understanding something of mining, the book will be most valuable, to the man not already possessed of such knowledge, it will be a most difficult one to understand, as it seems to us to presuppose a considerable knowledge of mines and mining. The author himself says that he aimed at giving the practical working systems of companies representative in their particular fields, believing that this treatment would be more generally appreciated than a theoretical discussion, and he has certainly admirably accomplished this particular object.

DIE SCHACHTFOERDERMASCHINEN. By Karl Teiwes and E. Förster. 6x9; pp. xvii+431, 232 illus.; cloth, 16 marks. Julius Springer, Berlin.

This book forms Vol. 3 of the series on Die Bergwerksmaschinen, edited by Hans Bansen, of which the two earlier volumes have been noted in this column. In our opinion, the present volume is the most scholarly that has yet appeared; this is probably due to the nature of the hoisting problem itself, which naturally permits a more mathematical and scientific analysis than was necessary in the preceding treatises on deep boring and on appliances for excavation and rock breaking. Few works in the English language have even attempted to cover the ground contained in this volume, and none has done it so exhaustively.

Part 1 classifies the hoisting systems and indicates the different relative position that may be occupied by shaft, sheaves and hoisting drums. Part 2 outlines the method of computing the necessary dimensions of a hoisting engine. Part 3 discusses the important problem of counterbalancing the dead weight of a hoisting rope, and outlines all the the common methods adopted to this end, tail ropes, conical drums, flat-rope reels, etc., as well as many others not in such frequent use. This discussion is based on mathematical principles throughout. Part 4 treats of ropes, and the construction of the drums on which they wind. Part 5 describes the several methods of speed control applicable to hoists in general. Part 6 relates to the design and construction of steam-operated hoists, including the valve motions, methods of reversing, interlocking drums, braking, preventing overwinding, etc. This part is characterized as much by thermodynamic analysis as by mechanical detail. Part 7 applies the electric motor to the hoisting problem, first indicating the characteristics of the several available types of motors and then pointing out their relative merits for this kind of work. The various methods of controlling and regenerating are discussed in detail.

The illustrations of the book are excellent. They consist mainly of diagrammatic sketches, in which the particular feature under discussion is emphasized. Others are working drawings with only a few main dimensions; reproductions of photographs are relatively scarce, since this kind of illustration seldom brings out details. The wiring diagrams in part 7 are unusually clear. A bibliography covering 10 pages offers a long list of works and papers relating to hoisting, selected almost exclusively from German literature. Finally, an index covering 10½ pages is provided. It is to be regretted that unfamiliarity with the language will tend to prevent a due appreciation of this book by many American engineers.

CORRESPONDENCE AND DISCUSSION

Conditions in Mexico

The killing of Boris Gorow by Mexican rebels was noted in the JOURNAL of Mar. 8, 1913, p. 537. The following letter gives some of the details, and also throws an interesting sidelight on Mexican conditions:

I do not know whether I wrote to you that on Jan. 17, I went to Los Laureles Hacienda near La Yesca in the territory of Tepic. I was engaged as surveyor from the Neuva & Buena Vista Anexas Mining Co. I was getting along all right when on Feb. 20, something happened that put an end to the business, at least for the time being. At 5 a.m. on the day mentioned, five bandits stole five mules out of the corral, fired through the door and windows of the house, and as they retreated, killed three workmen. Mr. Gorow, the mining engineer and Señor Gozueta, the superintendent, managed to drive the bandits off, but only wounded one of them. Anticipating that the bandits would return with reinforcements, we decided to fortify ourselves up in the mine. It is nearly an hour's walk from the hacienda to the mine.

The mechanic, Mr. Budd, and the geologist, Mr. Bromly, both Englishmen, reached the mine, but Mr. Gorow, Gozueta and I lingered on a mesa half way up to the mine and watched the road to see if the bandits would return. We did not have long to wait. There were about 150 of them, some searching along the main road below the mesa and the remainder ascending the opposite ridge to cut us off from going up to the mine. A Mexican on the mesa offered to show us where we could hide. Mr. Gorow and Mr. Gozueta paid no attention, but I did. I do not think they saw the crowd coming up the opposite ridge, otherwise they would not have been so foolish as even to try to offer resistance to such a large force of well armed men. The friendly native guided me and three Mexicans to a shaft in the middle of the mesa about 50 ft. from where we had been, and from where Gorow and Gozueta lay flat behind rocks and fired. Before we reached the hole, bullets were whizzing about our heads. The hole was about 10 ft. deep, and from the bottom was an inclined plane about 12 ft. in diameter. The entrance was about 4 ft. square and covered with bushes. While down in the hole, I heard Gorow and Gozueta fire about four volleys and then their firing ceased. The bandits kept up their fire for about four hours and then scattered over the mesa. Two of them looked into the hole where I and some Mexicans were concealed, but fortunately they did not see us. One of the Mexicans in the hole with us proved to be the informer who had told the bandits where we were. He ventured out of the hole to get a blanket, was shot in the left knee, and fell down a precipice.

After the bandits left the mesa, the friendly Mexican, who had shown us where to hide, brought me some dinner and that night brought me a native costume so I could disguise myself. He then took me to another cave above his hut. He mingled with the bandits in the day time and brought me their gossip and food and water at night. I stayed in the cave and could see the bandits scouring the hills after me. They filled Gorow with bullets and tore his gold teeth out while he was still alive, stabbed him, smashed his head with rocks, and threw him down the precipice. Gozueta, at the risk of breaking his neck, threw himself over the precipice to dodge the bullets. He escaped with his face badly bruised and in the dress of a peon, made his way to the City of Mexico, where he now is.

The bandits hunted through a mine for Bromly and Budd. They were found, but the bandits did not dare to approach their hiding place. I sent my Mexican friend with a note to let them know I was still alive. He caught them just as they were about to flee to the hills on mules, accompanied by three friendly Mexicans. They had given Gozueta and me up as dead. I sent them the note on Feb. 22, at noon, and leaving at night, I arrived at home in Hostotipaquillo ahead of them on the twenty-third.

It seems that the bandits compelled the authorities of La Yesco to send out four policemen to capture us dead or alive, accusing us of having killed the workmen at the hacienda, and they so aroused the indignation of the people of the town that bandits, police and populace were against us.

During the attack on the hacienda, and while Gozueta was driving them off, Gorow attempted to telephone to Hostotipaquillo for help, notifying the authorities of what was happening to us, but before the message was finished, the bandits had cut the wire.

Charles Bowker, an Englishman, tried to help us out through the British Consul by telephone without avail. Gorow managed to bite a finger off one of the men who was pulling out his teeth. This man and another bandit are now in jail at La Yesca, but a mob threatens to rescue them.

The goods from the store of the hacienda that was attacked, together with our clothes and even the shoes of poor Gorow, are now in the market square of La Yesca village, but the bandits got off with a lot of stuff.

T. K. W.

Hostotipaquillo, Mex., Mar. 1, 1913.

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Activity in Colombian Placers

The JOURNAL editorial of Mar. 8, 1913, which has only just come into my hands, relative to Colombian placers, is interesting and calls for little comment, but it reminds me that much less interest is taken in Colombian quartz mines than in its placer mines. I am not of the school that believes that because placer gold in commercial quantities exists in a number of streams and rivers, it is a natural sequence that workable quartz veins are as widely distributed throughout the country, but I am a believer in Colombia as a quartz-mining country.

Some time ago, I spent 14 months, the greater portion of the time in the state of Antioquia, investigating its mineral resources, visiting a number of placer and quartz localities. In no case, coming within my personal observation, did I find alluvial deposits of value in close proximity to workable quartz veins, though I understand that at certain points the two do exist in juxtaposition, such veins probably giving rise to the neighboring placers. As in the Mother Lode district of California, the placers are largely derived from small but rich stringers, lying in an easily decomposed country, stringers that are sometimes found and worked by pocket hunters, but can scarcely be considered of commercial importance except as nature concentrates them through the passing centuries. Quartz veins of importance exist throughout a wide territory and are worthy of more serious attention than has yet been paid to them. Marmato, Zancudo and Remedios are names that call to mind old and well known mines, while there are many more districts that are less well known but worthy of consideration.

Lack of transportation and consequent high cost of production has militated against the development of quartz mines in Colombia, probably more than any other one factor. Or rather the fear of high costs in districts of limited development has kept capital out of them. Both river and rail transportation improve from time to time, but poor trails over mountainous or hilly country will be the bugbear of many districts for years to come.

The objectionable climate, which you mention as one of the drawbacks of the placer fields, makes itself felt to but a limited extent in the hills and mountains where the most of the quartz veins have been found. Medellin, the capital of Antioquia, at an elevation of about 4500 ft., has

a delightful climate the year around. Nearly all the quartz locations I visited were at an elevation of 2000 to 6000 ft., and at such elevations disagreeable climate conditions do not interfere with health and operations. The quartz mines certainly have the better of placer mines in this respect. Tropical fevers certainly exist along the rivers and in traveling through the country one should take ample precautions or he will carry his troubles to higher altitudes, there to be bothered with them. It is the comparatively healthful condition of the country which causes one to be careless, to overlook the little precautions which, if taken, would avoid the most of the troubles. I have had fevers in Colombia and been laid up for several weeks at a time, all through pure carelessness. I have spent months on the West Coast of Africa, where everyone preaches care, and not been ill for a day. This does not mean that the Colombian climate is worse than the West African climate, but it does mean that if one can withstand the latter climate by taking care of himself, he need have no fear of sickness in the Colombian hills, if he will trouble himself to adopt the simplest precautions.

Quoting from your editorial: "Health conditions will * * * * be taken care of when the operations approach a sufficiently large scale to warrant systematic attention to sanitation." Health conditions should be of primary consideration. From the first inspection, during the investigation and before real operation begins, the man in the field should be just as careful as though he were on the force of an operating mine. Care of oneself is not dependent upon large operations, a hospital and extensive sanitary expenditures, it should precede all of these, otherwise the later operations may be conceived but may never be initiated. Permit me to repeat the words of warning which have often been given before in your columns: "No matter how inconsequential or how large the operations, no matter how short or how long the time of exposure, it is worth while to take every precaution known to science while within the tropical zone."

It is to be hoped that those who are now investigating placer deposits in Colombia will not overlook the merits of some of the veins in the hills, for they certainly merit more attention than they have yet received, and are bound to become important sources of gold when their capabilities are known.

F. F. SHARPLESS.

52 Broadway, New York, April 9, 1913.

Filtered Facts

Since the recent court decision in the famous filter case, operators seem to have been seized with panic and are nervously seeking means of avoiding the natural result of such a decision. A great deal of the apprehension of impending calamity is based on a misunderstanding of the real meaning of the law's expression. Contrary to the general impression, the meaning is not that there shall be but one filter, but it does mean that the process patent granted to Moore is sustained and that any other machine or process which follows the same steps, infringes. That is to say, that any process which forms a cake by difference of pressure on opposite sides of a filtering medium, washes the cake by passing solution or water washes through the entire thickness of the cake, and then discharges the cake by a reversal of pressure, using either air or solution or water, is following the Moore process. Evidently this does not cover the filter-press practice in which the press has to be opened to effect discharge, nor the Merrill system in which a hollow cake, washed both ways from the center, is made, and in which the cake is discharged by sluicing. Here, then, are notable exceptions to start with.

A general impression seems to be that an enormous burden is placed upon the mining industry by the result following the decision, but unless the victors are inclined to be extremely unreasonable, the reason for such an occurrence is not clear. It is immaterial whether one pays tribute to Jones or to Brown, and it is generally acknowledged that it is no more than just to pay someone for the advantages offered by the system.

To combat the decision of the court as to Moore's rights, and to demonstrate that the successful treatment of slime did not originate with Moore, the filter-press practice of Western Australia and the decantation process of South Africa are cited, but it seems reasonable enough to argue that had these methods been equivalent to Moore's process, the latter would not have displaced them. It is true that a form of decantation is now growing in public regard, but it is a refinement of the older practice, more economical and more efficient, just as Merrill's press is a refinement of the older filter press.

In fine, the situation is not desperate. Let us filter out the facts and discard conjecture and apprehension. The operator has little to do with the battles of patentees until he is threatened with inconvenience, in which case he is amply capable of compelling justice and resisting oppression.

FIAT LUX.

New York, Mar. 5, 1913.

Cooling Reverberatory Bottoms

In the JOURNAL of Mar. 15, 1913, p. 576, there is a description of Herreshoff's method of cooling reverberatory-furnace bottoms, for which apparently a U. S. patent has been issued. The method described was introduced by me at a large Australian smeltery 25 or 30 years ago, and was still in use and giving most satisfactory results up to the time of my leaving. The difference between the two schemes is that my tubes were nine-inch square brick flues, which ran fore and aft instead of across the furnace, and the air was drawn through by natural draught. A description of this furnace with drawings was published in the JOURNAL of Feb. 16, 1907. It is, therefore, difficult to see how a claim for a patent can be made, as there is obviously no novelty.

T. C. CLOUD.

London, Apr. 5, 1913.

Converting Twaddell to Specific Gravity

I note on p. 569 of the JOURNAL for Mar. 15, 1913, some formulas for converting Baumé and Twaddell to specific gravity. In converting a Twaddell degree, should not the factor be 20 instead of 200?

L. HEYNEMAN.

San Francisco, Calif., Mar. 28, 1913.

[The factor of 200 as published is a misprint. The correct figure is 20, as noted by Mr. Heyneman.—EDITOR.]

EDITORIALS

Findings on the Mount Lyell Disaster

The disastrous fire, which occurred in the Mount Lyell mine, Tasmania, Oct. 12, 1912, has been the subject of investigation by a Royal Commission. We reprint in this issue the greater part of the commission's report. For the three possible causes of the fire most commonly urged, namely, incendiarism, carelessness of the men and defective electrical installation at the pump-house where the fire started, the commission finds slight support in the available evidence and confesses itself unable to account for the fire's starting.

Any criticism of the management would be such as might apply to any mine, even the best managed, in this country or in Australasia. The housing of the electrical equipment in a wood structure without constant attendance, a break in the secondary line of egress, the absence of fire-fighting appliances, the extension of the duties of one pumpman over several levels, and the difficulty encountered in warning the men of the danger; these are conditions almost universal. They may have contributed to the magnitude of this disaster and the loss of life, but the general practice of the mining industry and prevailing public opinion, not the Mount Lyell company, should be the objects of blame. The management seems to have obeyed the provisions of the law in practically every respect. The cause of disaster cannot be traced, nor the responsibility fixed. But lessons of the highest value may be drawn from it.

Fire-fighting apparatus would have been useless here since it was impossible to approach the fire close enough to fight it after it was discovered. Nevertheless such appliances should be provided, as with them at hand, it may often be possible to check a fire before it gets a fair start; they are worth far more than they cost. The fact that in this case the workings were filled with carbon monoxide, which was probably chiefly responsible for the loss of life (something, obviously, that might easily occur with two exits, supposing the fire to be in such a place as to cut off access to the downcast shaft) should not be admitted as an argument against the two-opening provision of mining regulation codes.

The commission properly points out that a general notification of danger underground is a slow and difficult matter. One method of accomplishing it was suggested to the investigators, namely, to signal the alarm by flashing the lighting circuit. This seems an excellent scheme. While few mines are equipped with electric lights in all working places, many properties have illuminating or signal systems that cover at least the principal stations and by the use of some general alarm signal, a great saving of time could be effected in communicating a warning, since it would be possible to start messengers simultaneously from many different points.

The Mt. Lyell disaster indicates the following precautions as being necessary, among other things, against underground fires: Inflammable structures should be avoided underground so far as possible, especially in proximity to the downcast opening; the careless handling of candles should be prohibited, especially the practice of leaving a snuff burning on wood of any kind; electrical installations should not be housed in wood; finally, a general alarm should be provided for the electric signal or lighting systems, as offering a ready means of starting a warning through the mine.

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The Quicksilver Matter

A decidedly peculiar situation was developed during the recent controversy among the stockholders of the Quicksilver Mining Co., which owns the famous New Almaden mine, in California. At the last stockholders' meeting, charges of mismanagement were made against Charles A. Nones, president of the company, and his resignation was demanded. Mr. Nones declined to resign and the control of the meeting was taken away from him, the opposition being in the majority. However, he declined to answer questions or do other things that were demanded of him. In the course of the discussion it came out that the company is receiving the attention of the Department of Justice. We quote from a San Francisco newspaper:

> This came as a distinct surprise and shock to the stockholders, but Nones positively declined to give them any idea of the nature of the trouble, saying that in the first place he had given his word to the Federal authorities to keep quiet, and that in the second place it would not be "in the interests of the company" to divulge the facts.
>
> "Is this company now under investigation by the Department of Justice?" demanded one stockholder.
>
> "It appears so," responded Nones.
>
> "Who of the Government demanded the books?"
>
> "The Bureau of Investigation."
>
> "It is evident that Mr. Nones has given the Department of Justice some information," added another stockholder, "and I assert that we, as stockholders, have a right to know if our company has been guilty of criminal acts."
>
> "I cannot tell you anything," responded Nones, "for this reason: I have obtained immunity for my company for acts that were done by a former administration—criminal acts against the laws of the United States. You can pack a room full of stockholders, but you won't gain anything by that. I'll tell you right now that I am under promise, and that I will not say one word until I have the sanction of the Bureau of Investigation in Washington."

This is an example of the kind of embarrassment that often arises when stockholders are not told about their own business. The stockholders themselves are culpable, however, in failing to inquire. When a company is making money and paying satisfactory dividends, the stockholders seldom take the trouble to attend the meetings, much less to ask questions.

In the case of the Quicksilver Mining Co. it appears from Mr. Nones' remarks that it, in connection with other parties, may have been violating the Sherman law and that Mr. Nones has turned states's evidence under promise of immunity. It requires no great stretch of our imagination to guess that the matter pertains to a pooling arrangement for the sale of the quicksilver product of most of the California mines, about which there was formerly no great secret.

The Coppermine River Region

At the recent annual meeting of the Canadian Mining Institute, held in Ottawa, Dr. James Douglas gave a very interesting paper on the Coppermine River country, near Coronation Gulf, in the extreme northern part of Western Canada. Some time ago, Doctor Douglas outfitted a party to explore this country from which optimistic reports regarding the possibilities of copper mining had been received. The party returned last year.

The Coppermine River region is very difficult of access, but the country is comparatively flat and very barren, the hills rising to only a slight elevation. The party found many signs of copper, particularly in the form of native copper and copper carbonates, which have been formed from the weathering of the metal. The ore is disseminated through the diabase and conglomerate formations and the Indians have been known to find single pieces of native copper measuring 3x5 inches.

Doctor Douglas expressed the opinion that a strong company which could get a large concession on very liberal terms might make a success, as there would be no difficulty in concentrating the native copper. The ground would have to be very thoroughly prospected, and in order to work the properties, it would be necessary to build a railroad into the country, as navigation cannot be depended upon for more than one month in the year. The topographical features are such, however, that it will be comparatively easy to build a railroad.

Some of the Canadian newspapers heralded Doctor Douglas' statement, as the promise of a great new copper field in northwestern Canada, which will promptly increase the eminence of the Dominion as a copper producer. Intelligent hearers of his remarks know that he said no such thing, but merely indicated the probable existence of copper deposits that may be worth looking for. Even if such exist and they be found, it will be many, many years before that region could become a commercial producer of copper. Katanga will anticipate it by far, and nobody is now looking for anything immediately important from there.

The thing that most deserves comment, with regard to Doctor Douglas' report is his liberality in financing such an exploring expedition and promptly communicating to the world the results of it.

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Santo Domingo Mining Schemes

The shares of several gold placer-mining companies to operate in Santo Domingo are now being offered to the public. The broker's circular respecting one of these companies, which has come to our attention, is extraordinarily glowing and we understand that another promoter offers a guarantee that his poorest ground will average at least $2.50 per cu.yd. Such talk is in itself suspicious.

Suspicions respecting Santo Domingo gold placers are further aroused by recollections of the malodorous Santo Domingo Gold & Copper Co. of about seven years ago, of the salting of the samples of its gravel, of the deception of A. O. Brown & Co. and the fate of that firm.

We are informed that several groups of investors have been taken to Santo Domingo and have come back so enthusiastic "that they are now inducing their innocent friends to invest in the new El Dorado." One of these investors, in describing the large quantity of gold that was obtained from pannings under his observation, stated that "gold was so plentiful that really it was a constituent part of the soil." This has a familiar ring.

We have not seen any reports respecting the alleged Santo Domingo placers over the names of engineers that we recognize. We understand, however, that H. F. Lefevre, who is an engineer of well known experience and reputation, has gone to Santo Domingo to make an examination. Until Mr. Lefevre returns and the results of his observations become known we advise investors to be content with dreams of an El Dorado, and dreams only, and to keep a tight hold of their pocketbooks.

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Electric Tin Smelting

If there be any primary branch of metallurgy in which electric smelting ought first to find application we imagine it may be tin smelting. Tin ore, like zinc ore, will always, no doubt, be subjected to a preliminary mechanical concentration, because it will ever be cheaper to get rid of its gangue as tailings than as slag. Indeed, the very process of mining tin ore from alluvial deposits involves a concentration. Now, a high-grade concentrate, to be treated in but relatively small quantity, will stand metallurgical methods of a cost and refinement that can not be contemplated in the smelting of low-grade ore. As compared with zinc-ore smelting, tin-ore smelting is free from some of the serious metallurgical peculiarities which embarrass the zinc smelter.

Several years ago the process of smelting tin dross in an electric furnace at Connellsville, Penn., was described in a paper of the American Electrochemical Society, but not much data was given. However, a simple process and the ability to produce relatively clean slag was indicated. Lately some experiments in smelting tin ore have been made in Cornwall. According to an account given by a correspondent of the *Canadian Mining Journal,* in the production of 20 tons of tin, slags containing as little as 0.25% Sn, could be produced, but it was found best to make a slag assaying 15-18% tin in a primary smelting and 1.25-2% Sn in a final smelting. The tin bars were 99.5% pure. The average power consumption was about 2000 kw.-hours per 2240 lb. of tin, but some runs were made with only 1500 kw.-hours .

We may guess the power figures to correspond to 800-1100 killowatt-hours per 2240 lb. of ore (the ratio of tin to ore was not stated in the article), which with power at $20 per horsepower-year, would be about $2.40@3.30 per ton of ore. In ordinary smelting the coal consumption is about one ton per ton of ore. That figure does not compare very favorably with the best practice in zinc smelting, considering the less energy theoretically required to reduce tin oxide, but the tin-smelting furnaces are not so well designed thermically as the best zinc distillation furnaces. From the same consideration also, an electric tin-smelting furnace can probably be designed to do better than 800-1100 killowatt-hours per ton of ore.

Apart from the energy factor (heat) it was found in the Cornish experiments that only 14% of reduction coal had to be used and that it was indicated that there would be some saving in labor and some further advantage resulting from making the smelting process continuous. The advantages of smelting Bolivian ore at home will of course immediately occur to the metallurgist.

BY THE WAY

To those members of the Eighth International Chemical Congress who wish to dispose of complete sets of transactions, and to those wishing to obtain such sets, the Chemists' Club, 53 East Forty-first Street, New York City, offers its services, without charge to either side. The club will not in any way handle the books, take part in the negotiations, or be responsible for the results, but will simply put the members in communication. Registration, to take advantage of this offer, must be prior to Aug. 1, 1913.

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Between the Mulato River, in Chile, and Potosi, in Bolivia, a railroad, whose highest point is 15,000 ft. above sea level, has been constructed, says the *South American*. The road connecting Argentine and Chile reaches almost the same height. An English company purposes to construct a road still higher to unite Mexico City with Pueblo and ascend Mount Popocatapetel, this volcano being 17,500 ft. above sea level. This new line will serve principally to transport sulphur from a bed in the mountain.

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In the Iron River district of Michigan there must be a set of husky trammers in the iron mines. A court case was recently decided there in which an underground shift boss was fined $25 for assault and battery on the person of a trammer. As an excuse for blackening the trammer's eye, the shift boss claimed that the trammer threw a shovelful of iron ore over his shoulder, purposely hitting him. The trammer states that he threw the ore over his shoulder but that the hitting of the shift boss was an accident, and the court seemed to agree with this explanation. Possibly the justice of the court never experimented to see how far over his shoulder he could throw a shovelful of 55% iron ore in a narrow drift.

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In an address at the First National Conference on Marketing and Farm Credits, recently held at Chicago, B. F. Yoakum, chairman of the board of directors of the Frisco Lines, gave some figures that are of such interest as to be worth reproduction in these columns, even if they have nothing directly to do with mining and metallurgy. Mr. Yoakum said that roughly speaking the products of the American farms were purchased by the consumers of the country for 13 billion dollars and, of this amount, the first producers received six billion dollars or 46%. Five billion dollars go for expense of selling and dealers' profit, or 38 per cent. Waste by decay and loss in transit and in city markets amounts to 1½ billion dollars, or 12%. Of the 13 billion dollars the railroads receive a little less than half a billion dollars, or less than 4 per cent.

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All will please rise who have heard anything like this before: "A pharmaceutical chemist of Pine Creek, Australia, while experimenting with ores supposed to contain selenium, claims to have discovered a process whereby he can extract gold in payable quantities from ores that only show mere traces on assay. He went to Adelaide about 12 months ago and formed a syndicate, and has since been engaged in perfecting his process, and now claims that he has extracted 32 dwt. of fine gold, besides a quantity of silver, mercury and other metals, from two tons of Pine Creek stone that gave only a few pennyweights of gold on assay. The process is evidently based on the volatility o gold and other metals in the presence of selenium.' The one gentleman remaining seated is paralyzed.

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The United States Civil Service Commission announces a competitive xamination for mineral examiner, for men over 21 only, on May 21, 1913, to fill the position of surveyor for the inspection of mineral deposits under the Chief of the Field Divisions of the General Land Office, at $7 per day, and also positions of mineral examiner in the Forest Service at $1800 a year. The duties require an expert knowledge of geology, mineralogy, practical mining, and the land laws concerning mining claims on the public domain. Competitors will be examined in the following subjects: Spelling (20 words of more than average difficulty), 5; arithmetic (fundamental rules, fractions, percentage, interest, discount, analysis, and statement of simple accounts), 15; penmanship (the legibility, rapidity, neatness, general appearance, etc., of the competitor's handwriting in the subject of report writing), 5; report writing (test in writing in letter form a report not more than 200 words in length, summarizing and arranging in logical order a series of facts included in a given statement of 400 or 500 words), 10; practical questions (including surveying), 35; education, training, experience and fitness, 30. Persons who desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., for application and examination, Form 1800, mineral examiner, male.

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In the February issue of the *Railroad Man's Magazine*, Frank J. Arkins describes mine haulage under the title, "The Railroads Invisible." He has unconsciously chosen an appropriate title, says the *Colliery Engineer*, for such mine railroads as he describes were never seen. The following is taken from his description: "Every mine has such a railroad. Some have several tiers of them. One has 48, each 100 ft. below the other. Some have systems that are six, eight, and even 10 tracks wide in places, and have terminals far in the bowels of the earth, the roofs of which, sometimes weighing millions of tons, are held up by joists. A train starts up the incline from the bottom of one of these mines. It enters a passage barely wide enough to admit it. It roars by a number of great, abandoned openings that resemble a series of forgotten catacombs. It hugs the side of a cliff, below which the miners have excavated a world of raw material. It passes a heated zone, on whose other side a furnace, acres in extent, awaits only a breath of air to give it headway. Now it crosses a series of timbers that shake and tremble. Now the train rumbles through deserted workings, from the roof of which water drips. It strikes the face of the one human being on this weird ride, the single man the train carries. The next instant the cars plunge into a corridor that roars with the sound of other trains, and a moment later it dashes into the night air made damp by a steady drizzle. A short distance from the mouth of the mine a locomotive waits, burning an electric headlight. A lantern swings. The cars that have traveled miles underground are coupled onto the engine. They have now become a part of the country's mighty railroad freight." Did you know you had a railroad like this in your mine?

American Zinc & Chemical Co.

The new zinc-smelting plant to be built in the vicinity of Pittsburgh, Penn., to which we referred last week, is to be the property of a newly organized corporation, known as the American Zinc & Chemical Co., which will be an enterprise of the American Metal Co. interests. The latter are now engaged in a series of large metallurgical constructions, including the works of the Southern Aluminium Co., at Whitney, N. C., and the new lead refinery that is being built by the Balbach Smelting & Refining Co.

The new company, which will be managed by N. L. Heinz, formerly of the Matthiesen & Hegeler Zinc Co., has acquired 350 acres of surface land, and 2500 acres of coal land at Burgettstown, Penn., about 27 miles west of Pittsburgh, on the Panhandle railway. Construction work will be begun at once, and the first unit, of about 37,500 tons of ore capacity per annum, ought to be operating in 1914. Construction will then be continued to give a capacity of 75,000 tons of ore per annum.

The Burgettstown site was taken over after an exhaustive examination by Mr. Heinz and Dr. Otto Sussman, including drilling to test the underlying coal measures.

As the nearest town of any size, Canonsburg, is about four miles away, a model village is planned, upon which work has already been begun.

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Federal Mining and Smelting Co.

Sydney Norman, on behalf of the minority stockholders of the Federal Mining & Smelting Co. has issued a circular letter, criticizing the recent report of that company, in which he says, in part:

Assuming the figures in the report are correct and that production has been maintained at last year's average of approximately 10,000 tons of ore and concentrates per month, containing an average, as last year, of 42% lead, it is evident that about 22,680 tons of lead have been produced in six months after allowing usual deduction of 10% for "smelting loss." The average price of lead from September 1, 1912 to February 28, 1913, was $4.614 per cwt., or 23c. higher than the average quoted in the company's last annual report.

This does not agree with the statement in the Secretary's report that "earnings were made in spite of the prevailing low price of lead." The report also fails to mention that the average price of silver for the same period was 62.881c. per ounce, as compared with 58c. recorded in the last annual report. This would account for added earnings of approximately 95c. per ton of ore, or roughly $9500 per month.

But, instead of receiving the price for lead above quoted, the Federal company, under provisions of its smelting contract, only received $3.94, or 67c. per cwt. less than the average price of lead, or no less than $5.06 per ton of ore and concentrates shipped. This means that on 60,000 tons produced in the six months covered by the report, the controlling trust has paid for the product shipped it by the Federal company over $300,000 less than its market value in addition to taking a smelting charge of $8 per ton amounting to $480,000. Other producers in the vicinity of the Federal company enjoy a freight rate to smelting points as low as $6 a ton, but Federal is, by the terms of the contract, to pay a freight rate of $7.15 for the privilege of doing business with the Guggenheims, although the greater portion of the product is shipped to a point where the freight rate is $2.75 per ton.

Summed up, if Federal enjoyed such a contract as that granted by the same trust to the Hercules mine (controlled by the family of Harry L. Day, president and general manager of Federal, who also draws a salary of $15,000 from stockholders) its six months' earnings would have been $892,600, instead of $520,000 as reported by Secretary Sweeny. This is at the rate of $1,785,200 a year, or 10% on preferred stock and a surplus of $585,200. Put in another way, if Federal received full value for its lead product, its honest earnings would provide full 7% dividends on its $12,000,000 preferred stock, full 10% on its $6,000,000 common stock and still leave a surplus of $345,000. This does not take into account the juggling of freight rates.

The world's visible supply of lead is running short and there is no question in the mind of any man acquainted with the real situation that, tariff or no tariff, the price will advance materially in the next few years, although it may be artificially depressed for a time by the Guggenheim interests using the bugaboo of the reduction of the tariff for that purpose.

A dispatch to the *Evening Post* from Washington under date of Apr. 15, says that complaint to the Department of Justice by Sidney Norman, that the Federal Mining & Smelting Co. is being dealt with unfairly by the American Smelting & Refining Co. will be investigated by the Government in connection with the pending general inquiry to determine whether the American Smelting & Refining Co. is violating the Sherman anti-trust law. The government will conduct a wide inquiry into the smelting situation, which will require several months to conclude.

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Report of Commission on the Mount Lyell Fire

Following the fire and consequent heavy loss of life, which occurred in October, 1912, in the North Mount Lyell mine, a royal commission was appointed by the Tasmanian government for the purpose of making an inquiry. The report of this commission to the State Governor, Sir Harry Barron, we reprint, in part, as follows:

We regret that from lack of convincing evidence on several matters arising in the course of the inquiry we cannot report with that degree of certainty which we should desire. Forty-two men are said to have lost their lives . . . . so that the . . . . evidence is necessarily incomplete. . . . . On our visits to the mine we could not view any level below that at 700 ft., and we were informed that the mine was still flooded at the lower levels. We were able to visit the ruins of the pump house at the 700-ft. level, but that part of the level was blocked, as we saw, beyond the pump house by an immense fall of rock. We visited also the 200-ft., 300-ft., 400-ft. and 500-ft. levels.

We find the following facts to be established by the evidence: On Saturday, Oct. 12, at about 10:40 a.m., and thereafter, the odor of burning waste was observed, and smoke was seen in the various levels of the North Mount Lyell mine. It was discovered that the pump-house at the 700-ft. level was on fire, and smoke issuing therefrom in such quantities as to prevent all approach to it. Apart from slight gusts which followed the cage up the shaft, the smoke at first quickly drew down the shaft and entered the lower levels. It subsequently permeated in greater or less degree the upper levels also. On the evidence before us, we find that this fire originated at the pump-house. It is stated that 170 men were below at the time in different parts of the mine. The figures are not given us as conclusive, though it appears they may be adopted as correct. Such of these men as had warning and appreciated the danger escaped by way of the main shaft, but others did not appreciate the exisence of danger, and made no attempt to reach the surface until it became impossible, while yet others were early cut off from communication with their fellows, even on the same level, so extensive are the ramifications of the mine, and could not be warned, though efforts were made to reach them. The 10 men whose bodies have been recovered died of poisoning by carbon monoxide, which was generated by the fire. Here our finding of the facts must cease. All else lies in the region of conjecture.

As to the cause of the fire, three possibilities are presented to us: (1) Incendiarism; (2) carelessness of the men; (3) some defect in the electrical installation in the pump-house at the 700-ft. level.

(1) It was suggested by counsel for the mine-owners that certain incidents deposed to indicate the possibility of incendiarism, and also of one or more separate fires occurring in various distinct parts of the mine at about the same time as fires at the pump-house. There is, in our opinion, no foundation in the evidence for such finding. The remains of a fire in an ore pass, remote from the pump-house on the 700-ft. level, were shown us, but until the 600-ft. level (now

in ruins) above that pass is completely cleared and explored, it is impossible to declare that to have been an independent fire; and, on the evidence before us, we conclude that it was not so. Some suggestions were made against certain of the men, but we have to report that we find no evidence of any sinister or careless act on the part of anyone.

(2) One witness alone (Gillies) deposed to having seen at the steel-house near the pump-house, candles burning under the men's billies to warm their tea, and the possibility of the fire from this quarter was suggested; but we do not consider it safe to rely on this evidence without some corroboration, and in the face of the evidence to the contrary. There is no evidence at all as to any other source from which a fire might have arisen through carelessness.

(3) We consider that the attempt to prove that the fire was caused through defect in the electrical installation fails. The reports of the experts are unanimous that the fire was not electrically caused in the pump-house, but arose externally to the machinery there. We consider especially useful the evidence and report of Mr. Medhurst, an independent electrician employed on behalf of the Crown, who was permitted by the company to take to pieces and thoroughly investigate the ruined machinery. On the evidence before us, we consider that the company did not, in all the circumstances, fail to take all reasonable precautions against accidents in the installment and care of this machinery, but we say this subject to the question raised under rule 44. The evidence as to alleged previous fires in this pump-house established one actual fire only, which occurred about three and a half years ago, and the evidence of its origin is quite inconclusive. The pump-house was remodeled thereafter, and the electric appliances rearranged, and we find it impossible to found any conclusion as to the fire on Oct. 12 last upon that previous fire.

As further causes of the loss of life from this disaster, the following are suggested:

(1) Employment of one man to attend to pump-houses—one at the 700-ft. and one at the 1100-ft. level. Reference was made to rule 44, under the Mining Act of 1905, as having been infringed in this particular. What is the correct interpretation of that rule is disputed, and no determination of this commission can settle this question of legal construction, but we record the fact (freely admitted by the company) that one man (Burns) attended to all the electrical motors and pumps at the 700-ft. and 1100-ft. levels. The pumps are automatically worked and started, and the duties of any attendant continually stationed at either pump-house would be limited to those of a watchman.

(2) The absence of special means to put out any fires. Neither the management, nor the men, nor the inspector of mines, nor the men's "check inspectors" ever contemplated the possibility of any fire at this pump-house or elsewhere in the mine, and the company frankly admits that no special provision against fire was ever made or thought necessary. Witnesses state that it was impossible to get near the fire for the smoke. Consequently the presence or absence of fire-fighting apparatus did not affect the result.

(3) The failure to provide any other exit than the main shaft. We are advised by the solicitor-general that the law does not require more than one exit from a metalliferous mine, but in any event, we find that there were at the time of the disaster passes extending in various directions to all the levels throughout the mine, whereby, in the event of the collapse of the main shaft, or almost any occurrence other than the generation of deadly fumes, men could have been rescued. But, while this fire was in progress, many of these became mere passages for smoke and fumes, and rendered rescue work very difficult and hazardous. We find that at the time of this disaster, there were no connecting ways fitted with ladders from the 500-ft. to the 300-ft. levels other than the main shaft.

(4) Failure to "pull the shift." This charge is not, in our opinion, substantiated. No witness could tell us of any systematic method, either prescribed or in actual use in Australia, whereby the men throughout a large mine can be immediately warned of danger and called to the surface. One witness informed us, from hearsay, of a system whereby the electric light is used to flash the warning through the mine. This appears to us worthy of consideration, with a view to its adoption.

Without further comment, we commend for earnest consideration the proposals of the chief inspector of mines, W. H. Twelvetrees, to embody in legislation the lessons of this disaster. We desire to suggest further that as an extreme precaution, and, in view of the entirely unforeseen circumstances of this disaster, no building in a mine at which there is not some person constantly present during the working hours should be constructed of pine or other easily combustible material.

Reported in New York

The stock of the Inspiration Consolidated Copper Co. has been listed in London.

The mine-smelter production of copper in January, 1913, was 137,301,253 lb., according to the JOURNAL's statistics. The refinery production in January was 143,479,625 lb.

A new modern zinc smeltery is being erected at Hohenlohehütte, Upper Silesia, to take the place of an old plant. The new plant is expected to be finished this summer.

The Valetin Coeq zinc smeltery of the Vieille Montagne Co., in Belgium, has been closed on account of a strike, which is an unusual occurrence in the affairs of this company.

J. S. Sheppard and Addison Cudworth, receivers of the United Copper Co., appointed Feb. 10, report on Apr. 15, that claims aggregating $2,638,023 have been filed and that assets reach $6,145,829, of which the largest item is $4,033,333 of the Pittsburgh & New York Coal Co.'s stock.

The Guggenheims are going to bring out a new company to take over the Chuquicamata copper mines of Chile, which have been under development by the Chile Exploration Co. It is said that $15,000,000 worth of 7% bonds are to be offered at par, these bonds to be convertible into stock at $25.

The present administration of the Vulcan Detinning Co. is the subject of attack by John Muir, stockholder, and Charles P. Hull, secretary, who allege that the directors have overpaid themselves for the services rendered, besides rendering bills for "special services" of no value, and that they also conducted outside business for the company at an unfair profit to themselves.

Moore Filter Patents in Australia

In the January number of the *Journal* of the Chamber of Mines of Western Australia, it is stated that the Chamber has formed a combination of mining companies to resist any claims made by the Moore Filter Co. for payment of royalty and to assist in defending any suits brought against companies using the vacuum filter process for alleged infringement of patents. The combination will have a fund of about £25,000 at its command.

The above, when submitted to the head office of the Moore Filter Co., in New York, elicited the following comment:

The foregoing confirms in substance a statement made by Mr. Moreing, of the firm of Bewick, Moreing & Co., to the president of this company in London the latter part of December, 1909, or the early part of January, 1910, as indicating that any effort on our part to secure the proper recognition of our rights in Australia was to be contested. Therefore, we are not surprised to note that the "combination" to oppose us has been effected. We are not, however, in the least perturbed. We feel entirely confident as to the outcome of the litigation, regardless of the size of any "fund."

Mexican Petroleum Output

The development of Mexico's petroleum industry is shown by the accompanying statistics of output of crude oil in the past six years, according to *Daily Consular and Trade Reports*:

	Bbl.		Bbl.
1907	1,000,000	1910	3,332,807
1908	3,481,410	1911	14,051,643
1909	2,488,742	1912	16,500,000

PERSONALS

Allen H. Rogers has returned from Butte.

H. C. Hoover will arrive in New York this week on the "Mauretania."

Charles Kirchhoff sailed for Europe, Apr. 12, for an absence of several months.

W. H. Shockley arrived from London this week on his way to San Francisco.

Alden H. Brown has returned to New York from examination of iron properties in Cuba.

D. M. Riordan has gone to the Pacific Coast, expecting to return to New York in about six weeks.

Charles Tozer has succeeded S. R. Porter as superintendent for the Vivian Mining Co., in Mohave County, Arizona.

W. W. Carpenter, of Tucson, Ariz., has gone to the Magdalena River country in Colombia to construct a mill and cyanide plant.

V. E. Barnett, of the Tomboy Gold Mines Co., Smuggler, Colo., has gone to England on a vacation. His address while abroad is Bramshot, Weybridge, Surrey.

W. B. Fisher, formerly manager of the Colorado mine at Butte, Mont., will take charge of the Michigan-Utah properties at Alta and Big Cottonwood, Utah.

A. H. Case has resigned as manager of the Tennessee Copper Co. and has joined the staff of Lewisohn Brothers in New York as consulting engineer. A testimonial dinner was given to Mr. Case on Apr. 12 at the Blue Goose Inn, Copperhill, by the staff of the company.

The Privilege Committee of the House of Commons has found that Sir Stuart Samuel Montagu has violated the statute, in that the firm of which he is a member, conducted purchases of silver for the Indian government while he was a member of the House of Commons.

J. Parke Channing is still at Miami, where he is directing operations in the absence of Mr. Gottsberger, who has been seriously ill. Mr. Gottsberger is now in California and is reported to be recovering nicely. It is thought that Mr. Channing will hardly be able to return to New York before the end of May.

Llewellyn W. Jones, works manager of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., and the Manganese Steel Safe Co., Plainfield, N. J., has been appointed works manager of the plants of Wm. Wharton, Jr., & Co., Inc., at Philadelphia and Jenkintown, Penn. He has charge of manufacturing at all the four plants named.

John Stephens, who for the past seven years has been superintendent of the Parkersburg Iron & Steel Co., manufacturer of black and galvanized sheets, Parkersburg, West Va., retired on Apr. 1, after 54 years of service in the rolling-mill business in this country and England. W. L. Danks, who has been with the Parkersburg company for six years, succeeds Mr. Stephens as superintendent of the plant. Mr. Stephens expects to retire from all active connections with work in the mill and devote his time to travel.

OBITUARY

John Beck, an old-time resident of Utah, died at Salt Lake City, Apr. 2. He was one of the pioneers in the Tintic district, and was the discoverer of the Bullion Beck mine. Mr. Beck made and lost several fortunes. He devoted large sums to philanthropic purposes, built the first Mormon meeting house in Eureka, a school house, etc., at his own expense. He was interested in the Crown Point, Northern Spy, Governor, and Buckeye mines. He owned the Eureka mine, but later lost it through litigation. He built the first sugar factory to be erected in Utah, at Lehi, and was interested in many other enterprises.

James E. Parker died at Bishop, Inyo County, Calif., on Apr. 3. He was born in Iowa City, Iowa, in 1845, and was educated in that town. In 1863 he went to Virginia City, Nev. He was a writer on the Virginia "Chronicle" during the period that Mark Twain, Dan de Quille, C. C. Goodwin and other prominent men were connected with journalism on the Comstock. In 1869 the rich strikes at Cerro Gordo in California attracted him into that camp, and his report of the development of the camp led to the establishment of the "Inyo Independent" in June, 1870. He was elected to the California Legislature to represent Inyo, Mono and Tuolumne Counties in 1873. He severed his connection with the "Independent" in 1882, and thereafter lived in Big Pine and Bishop. He was largely identified with the mining industry, and to his journalistic efforts much of the development of the mines in Inyo County has been due.

SOCIETIES

International Geological Congress—Notice is given of a change of date of the meeting. It will begin at Toronto, Ont., on Aug. 7, instead of Aug. 21, as previously announced. The sessions will terminate on Aug. 14. Arrangements for the various excursions are unchanged, except as to date.

Missouri School of Mines seniors are on the annual senior trip to various points in Missouri. One week will be spent in the Joplin district, one week in the Flat River district, and one week in the various metallurgical plants about St. Louis. The class is accompanied by C. R. Forbes, professor of Mining; Durward Copeland, professor of Metallurgy and Ore Dressing; G. H. Cox, professor of Geology; Dr. A. L. McRae, professor of Electrical Engineering; and H. T. Mann, instructor in Metallurgy and Ore Dressing.

INDUSTRIAL NEWS

The Buffalo office of the American Cyanamid Co. has been moved to 528 Ellicott Square.

The Goldschmidt Thermit Co., 90 West St., New York, in its pamphlet No. 29, again describes the method of welding with thermit, a mixture of finely divided aluminum and iron oxide. Thermit is used for repairing crusher shafts, broken crankshafts, broken teeth of steel pinions and gears, and in welding heavy sections of wrought iron and steel. In many cases, the welds are made without removing broken sections from position, thereby saving in time and expense over other methods. The advantages of making such repairs on the spot are obvious.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

DRILLING—Chuck for Rock-Drilling Machines. Rufus P. Windsor, Elkton, and Charles H. Boehler, Cripple Creek, Colo. (U. S. No. 1,057,605; Apr. 1, 1913.)

DRILLS—Dust Collector for Drills. Ernest J. Mayer, Hesperus, and Oscar L. Walton, Goldhill, Colo. (U. S. No. 1,057,568; Apr. 1, 1913.)

HYDRAULIC CONCENTRATOR. Frank E. Marcy, Salt Lake City, Utah. (U. S. No. 1,056,923; Mar. 25, 1913.)

ELECTRIC FURNACE and Method of Operating Same. George Hillard Benjamin, New York, N. Y. (U. S. No. 1,057,213; Mar. 25, 1913.)

ELECTRICAL REDUCTION FURNACE. Hamden H. Noble, San Francisco, Calif. (U. S. No. 1,057,082; Mar. 25, 1913.)

ELECTRIC FURNACE—Revolving Electrical Furnace with Resistances Arranged Diametrically. Ottokar Serpek, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,057,286; Mar. 25, 1913.)

ROASTING—Multiple-Floor Furnace for Roasting Ores. Reinhold Scherfenberg, Berlin, Germany. (U. S. No. 1,057,584; Apr. 1, 1913.)

AMALGAMATION—Stone Muller for Amalgamating Pans. Gustave A. Gelien, San Francisco, Calif. (U. S. No. 1,057,540; Apr. 1, 1913.)

DREDGE—Dipper Dredge. Arthur W. Robinson, Montreal, Que. (U. S. No. 1,057,501; Apr. 1, 1913.)

ORE FEEDERS—Improvements in Ore Feeders. H. E. Waters and J. L. Cawthorne, Boksburg, Transvaal. (Brit. No. 21,110 of 1912.)

ELECTRIC FURNACE for Iron and Steel. A. L. J. Queneau, Philadelphia, Penn. (U. S. No. 1,057,669; Apr. 1, 1913.)

REFINING—Improvements Relating to a Refining Process for Iron and Steel by Means of Ferro-Chrome Alloy. J. Buchel, Westfalia, Germany. (Brit. No. 8479 of 1912.)

REGENERATIVE FURNACES—Improvement in Reversing Valves for Regenerative Furnaces. J. Maerz, Breslau, Germany. (Brit. No. 17,542 of 1912.)

TUNGSTEN—Improvements in the Manufacture of Tungsten and Its Use in the Catalytic Production of Ammonia. Badische Anilin & Soda Fabrik, Ludwigshafen-on-R., Germany. (Brit. No. 1161 of 1912.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Apr. 8

Forbestown District Gives Promise of Renewed Activity during the coming mining season. This will result from the reopening of the Gold Bank-Golden Queen mine by the Forbestown Consolidated Mines and work in the Burlington mines and the opening up of other new claims in several parts of the district. The Gold Bank-Golden Queen shaft timbering was repaired, the orebodies were developed and a 20-stamp mill was built during the last half of 1912. At the beginning of 1913, the building of a cyanide plant was started, which is now completed. Tests made prior to the reopening of the mine indicated that the ore could be satisfactorily cyanided. Upon the success of treatment of the ore at the Forbestown Consolidated will depend largely the development of other mines and renewed activity in prospecting and developing new and old claims. Several of the smaller properties have been developed during the last season, but in December, 1912, and the early part of January, 1913, a heavy snow and freezing of the water ditches, retarded development. The physical conditions of the camp are such that an electric-power plant may be economically established to provide power for all the mines in the Forbestown and adjoining districts. The development of the Burlington has proceeded slowly, but with care. During the bad weather the retimbering of the tunnel was the principal work done, the deepening of the shaft was to be resumed when the weather moderated.

A Record in Shaft Sinking was made in March at the Springfield mine in Tuolumne County. The shaft is being sunk with three compartments, and is timbered. Sinking was begun Feb. 25, and was completed Mar. 27, to a depth of 195 ft. Two Damas machine drills were used by a crew of four men on each shift; three shifts were worked. These men did the drilling, timbering and mucking. A one-ton skip was used for raising the spoil. Two men framed the timbers. The formation in the shaft is basaltic breccia, tightly cemented. This rock makes stiff drilling, but it breaks well. Good time was also made in tunnel driving at the same mine. The tunnel is 8x8 ft. in the clear, and requires little timbering. Driving was started with hand drills the morning of Feb. 7; Feb. 14, one Damas drill was used; Mar. 27, the tunnel had been driven to the 620-ft. point, making an average of 12.91 ft. per day. Three men were employed from Feb. 7 to Mar. 16, on each of three shifts. From Mar. 16 to Mar. 27, four men were employed on each shift. The mine is being developed by the Springfield Tunnel & Development Co. Another previous record of shaft sinking is that reported from Montana where 185 ft. was sunk in 30 days. Prior to that 180 ft. was made in 30 days in the Cross shaft of the Utica at Angels Camp, Calif. In that work four machine drills were used and eight men were employed on each shift, besides the crew for timbering and another crew for framing timbers.

DENVER—Apr. 10

A Report on the Mining Industry of the State has just been published by the state mine inspector, T. R. Henahen. It contains valuable data and statistics regarding the yields of mines for several years. It is stated that for every $100 contributed by farms to the state's revenue the mines contribute $60, but that the mining industry receives state aid only to the extent of $42, to every $100 received by agriculture. Mr. Henahen urges a greater effort to further the mining industry.

Pollution of Streams May Become the Basis of a Suit against the Mary Murphy company. It is alleged that tailings from the new mill of this company at Romley on Chalk Creek, a tributary of the Arkansas River, contain chemicals that are poisoning the fish in the river. Samples of the water have been taken, and will be submitted to the state chemist for analysis, and should poisonous chemicals be found in large enough amounts to be a menace to the fish, the matter will be presented before the state fish and game warden. The manager of the Mary Murphy company has denied the presence of any poisonous chemicals in the tailings discharged from the mill.

Requests for Leases in Eagle County on land owned by the state in the vicinity of the recent silver discoveries has been refused by the state land board until more facts about the district have been determined. The richest vein is said to pass diagonally through the state land. As soon as the snow melts, and the weather conditions permit, the mineral superintendent of the state will make an examination of the surface, surveying and dividing the area into mineral lots of 10 acres each. Applications for leases will then be received and considered by the board, allowing not more than two mineral lots to one applicant or individual, the object being to protect the rights of the prospector and encourage him as far as possible. When the leases are granted the lessee will be required to develop continuously the claims allotted to him on the following terms: For filing application to lease one or two mineral lots, $5.50; survey fee for each lot, $10; lease fee, $1; bond fee, $1; annual rental for each lot, $10; and a minimum royalty of 10% of the gross proceeds on all marketable ore, the royalty being increased on a sliding scale in accordance with the valuation of the ore. Prospectors already on the ground will be given the first chance to obtain a lease upon the claims. The state owns about 640 acres of land in the vicinity of the Eagle strike, and no ore will be allowed to be shipped and marketed from any of the mineral lots on the school section until leases have been granted by the board.

BUTTE—Apr. 8

Bullion Worth $116,019 was Received in March at the U. S. Assay Office at Helena, from the counties of Montana. Fergus County led with a production of $42,040; the other counties in the order of production being Madison, $36,995; Lewis & Clark, $22,189; Chouteau, $13,561; Powell, $505; Silver Bow, $299; Missoula, $261, and $169 for Broadwater County.

Miners Received $3.50 per Day in March, in accordance with the contract between the Anaconda Copper Mining Co. and the miners' union, the average price of copper for the month having been below 15c. per lb. By the terms of the contract miners are to receive $3.50 per day each month that copper averages under 15c. per lb.; $3.75 when over 15 and under 17c., and $4 for any price above 17c. per lb. The company has more than held to its contract, as for two months previous to March the amount paid the men was 25c. per day more than was called for.

Reconstruction of the Boston & Montana Smeltery at Great Falls, which has been under way for some time, is being advanced as rapidly as possible, and the structural steel work on the buildings is rapidly nearing completion. It is estimated that the entire cost of the work will be in excess of $2,500,000. All of the buildings are to be of steel and reinforced concrete. With the completion of the work the largest reverberatory furnace grate ever used in the district will be put in operation. The grate when mounted will weigh more than 100 tons, the sides weighing 15 tons each, and each of the 14 grate bars will weigh about four tons.

SALT LAKE CITY—Apr. 10

Lead Ores Are Utah's Most Important Source of Precious Metal production, as shown by Mineral Resources for 1911. During this year there were produced 30,668 oz. of gold and 7,442,188 oz. of silver from lead and zinc ores. The production of silver from lead ores was 6,083,877 oz., with an additional 1,358,311 from lead-zinc ores. Gold amounting to 25,709 oz. was recovered from lead ores proper, and lead-zinc ores furnished 4959 ounces.

The Silver King Consolidated vs. the Silver King Coalition Co. case in an accounting for ore extracted from the Vesuvius claim at Park City, owned jointly by the two companies, which was decided by Judge Marshall of the U. S. Circuit Court of Salt Lake City in favor of the plaintiff, and later carried to the U. S. Court of Appeals at St. Louis, was decided Apr. 5 by the St. Louis court. This court affirmed the decision of the lower court, but increased the judgment by $23,900. The case was brought before the local court in December, 1909, and the trial ended in June of the following year. A judgment in favor of the Silver King Consolidated for $734,242 was rendered by Judge Marshall in April, 1911. Both sides appealed the case. The amount of the judgment allowed by Judge Marshall was arrived at by determining the value of the plaintiff's half of the ore taken from the Parson's stope at $516,264. Interest at 8% from Jan. 1, 1906, made a total of $734,242 at the time of Judge Marshall's decision. Interest accrued since this time, two years at 8%, amounts

to about $117,000 more, exclusive of possible interest on the amount of the increase allowed by the St. Louis court. A bond for $1,000,000 was filed by the defendant at the time the case was appealed.

Capital Invested in Utah's Salt Industry amounts to $1,068,000, and about 90 men are employed. The salt output during 1911 amounted to 51,478 tons, having a value of $115,556. The total included 11,716 tons of refined salt, 33,562 tons of crude salt, and 6200 tons of rock salt; 45% of the salt was sold outside of the state, the principal markets being Idaho, Montana, Washington, Colorado, Nevada, New Mexico and Wyoming. Some salt is sent to Los Angeles for packing purposes. East of Colorado, the freight rates are prohibitive, and the Utah product cannot compete with salt from Kansas, Michigan and New York. A little more than one-fifth of the output is used in Utah for table purposes. The Inland Crystal Salt Co. is the largest producer, and manufactures salt by solar evaporation on the shores of Great Salt Lake. This company owns or holds easements to a large area along the east shore of the lake. Water is pumped by electrically driven centrifugal pumps at the rate of about 12,000 gal. per min., and runs through flumes and ditches into the evaporating ponds. The season lasts from February until September, when the floors of the harvesting ponds are covered with a 3- to 6-in. layer of crystalline salt, or about 700 tons of salt per acre. The salt is shoveled into piles from which it is loaded directly into railroad cars. The cost of production is said to be 35c. per ton. Salt for domestic use is treated at a refining mill near-by, where it is ground, and refined. The crude salt is packed in burlap bags, and sold as it comes from the stockpiles. A large part of the rock salt produced comes from near Richfield in the south central part of the state.

DEADWOOD—Apr. 11

Bullion Purchases at the U. S. Assay Office at Deadwood amounted to $1,748,000, according to assayer in charge, L. P. Jenkins. The figure is a little below normal, but is good for that period of the year. Operations were curtailed at several properties, and one, the Wasp No. 2, suspended. All of this was due to severe weather.

Oxyacetylene Torches Were Used at the Ellison Shaft of the Homestake company, in making repairs made necessary by a cage dropping and taking the cable with it. Two spokes and the rim of the reel on the big hoisting engine were broken, but a strong weld was made, and since resuming work no signs of weakness are apparent.

Development at Carbonate Camp Will Soon Commence, now that practically all of the timbers contracted for have been delivered. It is proposed to reopen this long dormant camp by sinking a shaft 400 ft. deep, at which depth it is expected that quartzite will be reached. From that level extensive lateral explorations will be made. Much interest is locally manifested in the enterprise.

Additional Electric Power for the Northern Hills is assured by the promised completion, at an early date, of the high-tension transmission line to connect the Dakota Power Co. plant, on Rapid Creek, with the distributing lines of the Consolidated Power & Light Co., which thoroughly cover the mining region of Lawrence County. The Dakota company has contracted to supply 1000 hp. from its plant, which is operated by water power.

Custer Peak District Promises To Become Prominent this summer, as numerous claim owners are preparing for extensive work. The Custer Peak company will resume development at an early date, as will the Imperial Copper Co., adjoining. Both have good surface prospects, which have shown well to a depth of 200 ft., where both native copper and sulphides have been encountered. The Kaleva Mining Co. has secured the Finlander property, a producer of rich free-milling ore, and extensive development is planned for the season. It is also reported that the Alma Queen mill be operated, as soon as repairs are made and the mine is cleaned out and prepared for production.

TORONTO—Apr. 12

The Bill Providing for an Eight-Hour Day for underground mine workers had a second reading in the Ontario Legislature on Apr. 9, by a unanimous vote, which makes its adoption practically certain. Iron mines are included in the bill, but there is a clause providing that they may be exempted from its operation in cases where the mining inspector reports the mine to be in good sanitary condition.

Reduction of the American Tariff on Lead and Zinc would stimulate mining of these ores in Canada and the prospect of reduction has already caused renewed interest in the lead-zinc deposits of eastern Canada. A zinc property in Quebec is being examined by engineers for an American company and other negotiations are being made. Canadian operators desire a reduction of the now prohibitive duty on fluorspar and some of the minor minerals, deposits of which are now unworked because of the exclusion of the products from the American markets by the duty.

The Gradual Extension of the Mineral Areas in Northern Ontario is evidenced by the fact that during the last month, six properties outside of the Cobalt and Porcupine districts, shipped ore. Silver shipments were sent out from the Wettlaufer mine in South Lorraine and the Casey Cobalt in New Liskeard. The Foster property, in the Kirkland Lake district, shipped a carload of high-grade gold ore and the Alexo at Iroquois Falls, shipped 150 tons of high-grade nickel ore. Two companies, the Teck Syndicate and the Dane Company, near Matheson, shipped 85 tons of copper ore. It is believed that during the coming season, more prospecting will be done than during the last two years and it is hoped that this will lead to the discovery of some new mineral areas. A large part of Northern Ontario is as yet practically unprospected and there is a large area of Keewatin rock extending irregularly through Northern Ontario, the new district of Patricia and Manitoba, and there are possibilities that active prospecting in these fields will lead to the discovery of valuable minerals. The completion of the Algoma Central & Hudson Bay R.R. from Sault Ste. Marie to the town of Hearst on the Transcontinental has also opened a large territory. The railway company received a grant from the government of 2,000,000 acres of land and of this amount, it is believed that 1,500,000 acres are worthy of prospecting. It is altogether probable that during the coming summer, the railway company will throw this land open to the prospectors.

SUDBURY—Apr. 12

Recent Deals Throughout the Sudbury Nickel Range have created great activity during the last few months, and this has lately been intensified by the announcement that the Crown Reserve Mining Co., of Cobalt, has taken an option on the Davis property. No definite action has as yet been taken by the Crown Reserve, but the property will be investigated and if it should be found to be as represented, it is probable that it will be developed. It is understood that the Crown Reserve company has interested Germans who are anxious to buy either nickel ores, nickel matte or refined nickel.

PORCUPINE—Apr. 12

A Decision in Connection with the Porcupine Strike and the action taken by the Hollinger company in instituting proceedings against 300 men who went on strike without notice as required by the provisions of the Lemieux Act, has been made by Judge Kehoe in the appeal against the three convictions made by the magistrate of Porcupine. The history of these cases was that two men, Holawaska and Cleary, were each fined $500 and costs or 90 days in jail and a third man, Croft, was fined $50 and costs or 60 days in jail. The three men were committed and subsequently released under the ticket-of-leave act, pending the result of an appeal. As a result of the appeal, Holawaska and Croft were released, but the conviction against Cleary was sustained. This decision will have an important bearing on all labor throughout the country.

Shortage of Power Due to a Serious Breakdown at the Wawaitin power plant, is being experienced. It appears that the two 8-ft. penstocks from the surge tank to the power house were supported only at long intervals. The work of laying the penstocks was done before the present company took over the plant and apparently they were not informed as to the actual conditions. A heavy covering of snow prevented inspection of the penstocks and when a leak developed there was nothing to show its existence. The leak increased rapidly and washed out the earth between the concrete supports, allowing the penstock to sag, and finally to break. The rush of water tore up the earth and it is expected that it will be two months at least before a satisfactory service can be resumed. In the meantime, the only power in the camp is being supplied by the Sandy Falls plant, which is not of sufficient capacity to operate all the mines at present using electric power. As a consequence, the Pearl Lake company closed down and the power supplies of the McEnaney and McIntyre have been curtailed. Special efforts have been made to supply the Dome and the Hollinger although they have not as much power as they need. Fears were expressed in some quarters that in the event of a sudden break-up, there is danger of the dam at Sandy Falls going out and in such a case, the camp would be totally without electric power until the Wawaitin plant is in commission again.

THE MINING NEWS

ALASKA

Juneau District

AN EIGHT-HOUR LABOR BILL WAS PASSED by the territorial senate Apr. 2, limiting the hours of labor for men employed in quartz mines to not more than eight hours. Where threatened with a scarcity of water, placer mine operators may work men overtime. This provision virtually makes the eight-hour law of no effect in the placer camps of Seward peninsula.

ARIZONA

Cochise County

RELIEF—A contract has been awarded to Phoenix men for building a 50-ton cyanide plant to treat the 8500 tons of tailing in the dump as well as the tailing from the mill.

Gila County

BARNEY COPPER—Tunneling to connect with the main shaft 100 ft. below the collar, has been begun.

SUPERIOR & BOSTON—A contract has been made with the American Smelting & Refining Co. to treat all ores at El Paso for a period of two years. Plans are being made for a greatly increased tonnage in the near future. Drifting east and west on the 600-ft. level has progressed over 200 ft., while the raise from the eighth to the sixth level is expected to break through within a few days. The crosscuts on the tenth and twelfth levels are daily encountering changes in the formation, which are interpreted as indicating proximity to the main vein.

INSPIRATION CONSOLIDATED—The 180-ton waste pocket raise at the incline has been finished. At the testing mill concentration by the Minerals Separation flotation process is being tried. Contrary to the general impression the Inspiration company takes no part in these tests, merely having loaned the test mill and equipment to the Minerals Separation, Ltd. At the millsite construction work has been commenced on the cement warehouse, and the sand and crushed rock bins, and the concrete-mixing plant. One steam shovel is cutting for the railroad spur that is to run below the lowest part of the millsite on the north side. All railroad work is completed on the Inspiration division with the exception of one cut, and the rails have been laid to the millsite. A small locomotive will arrive in a few days and by June 1, the railroad should be in operation. As a large quantity of the material has already arrived and is stored at the lower Miami townsite, the completion of the railroad will be followed by a period of intense construction work. Grading for the site of the coarse crushing plant has already been commenced. Upon the completion of the grading, work is to immediately commence on the foundations. Work is going on at the three townsites of the company, which are named Moonshine, Copper Glance and Live Oak. These are located respectively on the hill west of the concentrator site, on the hill across the cañon from the Joe Bush tunnel, and on the hill across the cañon from Live Oak No. 1 shaft.

MIAMI COPPER CO.—Arrangements have been made for a wire-rope span over the 18,000-ton stockpile south of No. 4 shaft. A ¾-cu.yd. grab bucket will pick up and convey the ore to the bins. Work on the remaining 75,000 tons of ore in the stockpile at No. 2 shaft, which has been suspended for a short time, is to be resumed immediately. Four Deister "Multiplex" tilting tables were recently installed in the sixth mill unit and are proving highly efficient. The crushing plant is being remodeled so as to insure a ½-in. product. Specifications call for two additional sets of rolls, two screens and two elevators. All of the original rolls have been replaced by the massive 42-in. diameter by 16-in. face spring, Traylor special rolls. With the exception of unit No. 5, the chilean mills have been replaced by Hardinge mills. During the next autumn it is probable that the lower portion of the mill will be remodeled and possibly two more units will be added. J. Parke Channing states that the closing of the Cananea smeltery would in no way affect the company's operations, and that operations at Cananea are to be resumed shortly. Ore is coming largely from square-set stopes. The chutes in all the shrinkage stopes are finished and the rooms are being broken as rapidly as possible, however, it will be several weeks before they will be producing a large tonnage. The construction of the new system of tramming is under way. The original plans have been altered, the section of trestle, just recently built, north of the power plant, having been abandoned for the present, as by turning the course of the city canal to the east a sufficiently large space for present yard purposes will be acquired.

Pima County

THE PIONEER SMELTERY HAS BEEN CLOSED DOWN for an indefinite period in order to make repairs. Larger orebins are to be built and machinery is to be installed for handling matte and slag. A furnace is to be installed for the treatment of flue dust and concentrates.

MINERAL HILL—A shoot of 4% copper ore 60 ft. wide has been opened up for a length of 200 ft. on the 260-ft. level.

OLIVE CAMP—The concentrator is nearly completed and it is expected that it will be in full operation by the end of the month.

Pinal County

SILVER KING—This old mine three miles from Superior is reported to be bonded again.

ARIZONA-AJAX—The property is being equipped with a gasoline hoist and compressor. Work is confined to sinking on a 22-ft. vein of lead-zinc-copper ore.

KELVIN-SULTANA—The three-compartment shaft has been completed from the 300-ft. level to the surface. The shaft is equipped with an electric hoist operated from the newly completed 600-hp. central station. The west vein on the 300-ft. level is growing wider and the ore is rich in silver as well as copper.

Santa Cruz County

PROGRESSIVE—The mill is being operated steadily on free-milling ore of good grade.

AMERICAN BOY—Regular shipments will be begun shortly. Recent development work has opened much ore.

Yavapai County

BINGHAMPTON—As the result of a recent visit by I. T. Stoddard, the property is to be reopened under the direction of Charles Carmen.

BREED GROUP—The recent heavy fall of snow making it impossible to haul in timbers has caused the discontinuation of work in the Effie shaft temporarily.

LONE PINE—The mine was examined recently by H. W. Hayward for Richard A. Parker, of Denver, and is now being reopened under the direction of H. C. Shotwell.

Yuma County

SWANSEA—The mines and smeltery have been closed temporarily in order to arrange for future financial contingencies. The smeltery has been running behind every month and it is proposed to remodel the plant making many improvements. Extensive development work is planned for the mines as soon as the new manager arrives from France.

CALIFORNIA

Amador County

SOUTH EUREKA—Work has been resumed, the shaft having been cleared sufficiently to permit the extraction of ore. Forty of the 80 stamps are dropping.

CENTRAL EUREKA—Work has ben resumed with a small force of men. The shaft is cleared to a point below the 2200-ft. level and the water is practically out of the mine.

KENNEDY—A water skip in the north shaft jumped the track at the 1200-ft. station, resulting in tearing away a portion of the upper end of the headframe. No one was injured.

Butte County

MAGALIA AND NIMSHEW DISTRICTS ARE ATTRACTING ATTENTION through the merging of 14 mining properties which it is said will be sold to a syndicate of Koreans. Some of these properties have been producers. They have been recently inspected by J. F. Hubbard of Chosen and G. F. Dyer of California.

Calaveras County

STANDARD AMALGAMATED—This corporation is constructing an electric line from Fourth Crossing to the Economic mine. All rights of way have been secured by purchase. Development work is in progress in the mine. It is reported that a stamp mill and cyanide plant will be built.

Eldorado County

HOMESTEAD MINING CO.—This company, in which San Francisco and Sacramento men are interested, is developing a new property on Harrison hill northwest of Georgetown and adjoining the Mulby Point mine. A tunnel has been started to tap the vein at an estimated depth of 150 ft. John B. Farnsworth is superintendent.

Humboldt County

HORSE MOUNTAIN—A strike of good ore in the tunnel is reported. The ore carries copper and gold. Concentrates are being shipped to the Tacoma smeltery, but it is expected that a mill will be built at the mine. David Wilson of Eureka is manager.

Inyo County

ST. IVES—The shaft is being cleaned out and will be deepened below the present depth of 175 ft. E. E. Green of Bishop is superintendent.

Kern County

WILLIAM R.—A small milling was cleaned up at the Red Dog mill recently from which the recovery averaged $50 per ton. A gasoline hoist is being installed for development work. The property is south of Randsburg. R. Roschl and Edward Niehaus are lessees.

KING SOLOMON—The last cleanup of ore from the Wickard-Jensen-Walton lease milled at the Red Dog averaged $80 per ton. A 12-ton cleanup from the Quinn lease yielded $760, or more than $63 per ton. A strong vein of high-grade ore has been disclosed on the 100-ft. level of the Quinn lease.

CONSOLIDATED MINES CO.—The new mill at the Good Hope crushed 145 tons in the first month. The recovery of gold was $11,220, or an average of more than $77 per ton. The shaft will be equipped with a 20-hp. electric hoist. The gasoline hoist will be transferred to the Twin Brothers shaft.

G. B.—A 20-ton roller mill and cyanide plant have been ordered. The boarding house, assay office and other sur-

face improvements are being built. The shaft has reached a depth of 225 ft. and a large vein of low-grade ore has been disclosed. The mine is being operated by the G. B. Leasing Co. The mine is south of Randsburg.

Mariposa County

MELVINA—The mine has been unwatered to the 600-ft. level, above which development work is in progress.

VIRGINIA—The mine has been unwatered to the 400-ft. level. A cave between the 200- and 400-ft. levels retarded the work, but has been cleaned out.

Mono County

TIP-TOP—It is reported that a tube mill will be installed with a capacity of 40 tons. A pipe line 2½ miles long has been built for supplying water. C. M. Thorndyke, of Laws, is the principal owner.

Nevada County

NORTH STAR—In the year 1912 the company disbursed $300,000 individends, making a total of $3,786,989 in dividends paid since the organization of the company.

Shasta County

MOONLIGHT—The first shipment of bullion from this mine near Ingot in the Afterthought district, was recently shipped to the mint at San Francisco. William Snow is manager.

Trinity County

LA GRANGE—Eighty tons of 4-ft. steel rails, to be used as riffles in the sluices at this gravel mine, are being hauled by wagon from Redding to the mine, a distance of 60 miles.

Tuolumne County

GOLD SPRING COTTAGE—This mine near Sonora has been purchased by Japanese, who have bought a 5-stamp mill and steam hoist of the Karnac Mining Co., which will be installed at this mine.

ATLAS CONSOLIDATED MINES CO.—This is the name of a company formed by the owners of the Atlas mine at Tuttletown. The capital stock is $250,000. The incorporators are J. D. Hubbard, C. C. Concannon, Frederick Julian, Frank P. Pape, Robert Oehmig, of Chicago. The Atlas has been reopened and equipped with a stamp mill within the last year.

COLORADO

AN EIGHT-HOUR LAW WAS SIGNED BY THE GOVERNOR, Apr. 3, affecting miners and operators in mills and smelteries in Colorado. The law goes into effect immediately, as a saving clause and an emergency clause were written into the bill.

Adams County

AMERICAN SMELTING & REFINING CO.—The strike at the Globe smeltery has been settled. The men returned to work without their demands, an increase of 25c. in wages per day, permission to smoke during working hours and better and more sanitary flooring in the various parts of the plants, having been granted.

Clear Creek County

CAPITAL—The orebody opened on the seventh level is developing favorably.

SCEPTER—This property on Democrat Mountain will be reopened in the near future. E. J. Butts is manager.

LUCKY FIND—This property near Dumont is being developed by Clark & Co., lessees. The adit has been advanced 150 feet.

BROWN MOUNTAIN—A vein of high-grade silver ore has been struck in this property above Silver Plume. The mine is operated by Stephens & Ingram, Lessees.

LONE TREE—The vein has been intersected at a depth of 500 ft. by a crosscut from the Teller tunnel. E. M. Moscript is operating the property under bond and lease.

TOLLAND—Development of this property in the Cascade district will be resumed at an early date. The tunnel is 800 ft. long. The last vein intersected contains a small streak of smelting ore.

COMMODORE—A rich strike is reported at this property on Red Elephant Mountain. The shaft on the Tabor vein has cut an 8-in. streak of ore assaying 400 oz. silver per ton. R. B. Morton is manager.

DUNDERBERG-TERRIBLE — This mine at Georgetown, formerly a large producer, has been taken under option by representatives of English interests and will soon be examined. It is owned by New York men.

VINDICATOR—The crosscut tunnel driven into Gold Hill is now 1000 ft. long. A 5-ft. vein has been cut, which is supposed to be the Gold Leaf vein. The intersection is about 900 ft. below the surface. The vein will be developed by drifts.

GOLDEN GLORY—The crosscut tunnel, driven into Saxon Mountain from a point near Empire station, is now 1380 ft. long. Two promising veins have been cut. The first was intersected at a distance of 1350 ft. and assays ½ oz. gold, 18 oz. silver and 4% lead across a width of 10 in. The tunnel will be driven under the present contract to a total length of 1530 ft. Upon the completion of this advance, drifting will commence on the veins recently opened. J. F. Puchert is manager.

ARGO MILL—This plant at the portal of the Newhouse tunnel, is now in operation. Its capacity is about 125 tons per day. The ore is sampled and delivered to the mill bins whence it is fed to a battery of 20 stamps. The ore is stamped in cyanide solution, passed over amalgamated plates and through amalgam traps. The pulp is classified by Dorr classifiers. The sand is concentrated on Card tables, the middling from which is reground in a tube mill. The slime is treated in Dorr and Parral agitators. Dorr thickeners are used. After decantation and filtration the solution is passed to zinc-boxes for precipitation. The plant is operated as a custom mill. Ore is purchased from companies and lessees operating through the Newhouse tunnel and from others. Settlements are made according to a schedule which compares favorably with prevailing smeltery rates.

Gilpin County

NOTAWAY—This mine is operated by the Square Deal Gold Mining Co. The shaft has been sunk to the 750-ft. level and drifting is in progress. Both east and west headings have been advanced about 35 ft. The west heading has opened an 8-in. vein of 4-oz. gold ore. The shaft will be sunk to a total depth of 1000 ft. and levels will be driven at suitable intervals. The upper levels of the mine are being operated by lessees. Harry J. Wolf is consulting engineer.

WAR DANCE—Regular and satisfactory shipments of smelting ore are being made. A campaign of improvement and more extensive development will be commenced. A new hoisting plant will be provided. The shaft is being sunk from the 400-ft. level. On this level the vein is 8 in. wide and assays 13 oz. gold per ton. The orebody on the 250-ft. level is 8 in. wide and assays 3½ oz. gold per ton. The leasing company now in control of the property contemplates deeper development with a view of ultimately connecting with the Newhouse tunnel at a depth of about 1500 ft. John Larson is manager.

Gunnison County

A STRIKE OF RICH GOLD ORE has been made on the property of Peter Stoller, assays ranging from $1000 to $3000 per ton, in gold and silver, mostly gold. One shipment has been made and development is now going on to determine the extent of the rich deposit.

GOLD LINKS, AND REVENUE—It is reported that work will be resumed at these mines and that the mills will be started.

RAYMOND—At this mine, a raise is being planned for the 2330 vein, from which ore is now being taken out near the main tunnel level. It is proposed to go up on the vein 1400 ft. to the surface.

CARTER MINING CO.—A four-compartment raise is being lifted to reach the bottom of the old Volunteer shaft which is full of water. The raise will, when completed, have a total height of 1089 ft., and is at present 415 ft. up.

Lake County—Leadville

LOUISVILLE—The large compressor has arrived and will be installed at once.

Teller County—Cripple Creek

FREE COINAGE—The Colorado Mining & Development Co. holding a lease on the Coinage dumps and shaft is planning a mill which will have a capacity of 50 to 75 tons daily. It will probably be built in the town of Altman.

ISABELLA—A new strike has been made on the 500-ft. level of the Empire State shaft at a point north and east of the shaft where a promising flat vein has been opened. At the Kissel lease, which is one of the surface blocks 300 ft. east of the Empire State shaft, the initial shipment is now being hoisted. An electric hoist will be put in soon.

IDAHO

Bonner County

LITTLE JOE—This company has taken over and will operate the Imperial mine. Two tunnels have been driven having a total length of 1000 ft., the lower one cutting the vein at a depth of 400 ft. A raise has been lifted on the vein connecting the two tunnels. Ore has been blocked out which contains from 5% to 7% lead, and which is rich in silver. Work on a 50-ton concentrating plant will be begun immediately; it will be in operation in 60 days. A 3-ton auto truck will be used to transport the ore to the railroad, which is five miles from the mine.

Coeur d'Alene District

CONSTITUTION—Suit has been filed before the land office at Coeur d'Alene to remove the homestead entry which includes the entire holdings of this mine on the east fork of Pine Creek. The property is said to be more valuable for mineral than as a homestead. A tunnel 1250 ft. long has been driven which has opened the vein for more than 500 ft. The vein for this distance is 3 ft. wide and the ore contains lead and zinc.

NATIONAL COPPER—This property at Mullan has, since the strike made about three months ago, been developing a large vein of copper ore. The main drift on the 1700-ft. level is now in about 500-ft. in ore. Crosscuts from this drift have shown the ore to be from 50 to 100 ft. wide. The ore assays about 3% copper, and carries silver. Diamond-drill holes have shown that the ore goes to considerable depth below this level. The assays of the cores show a slightly better grade. A raise from the main level is also being lifted in ore. The ore occurs in parallel streaks some of which are high grade and can be shipped to the smeltery after hand sorting. The company is already preparing for extensive operation. A mill will be erected in the near future for the ore already developed would insure its operation for several years.

MICHIGAN

Copper

ADVENTURE—Drilling has been started in the eastern portion of the property to explore for the South Lake series of lodes.

SOUTH LAKE—At a depth of about 330 ft. the shaft has entered another copper bearing formation. A diamond drill is operating from the 300-ft. level to cut the lode that was reached in the shaft at a depth of 110 feet.

MOHAWK—The permanent surface equipment for No. 6 shaft is being rapidly erected. The cylindrical rock bins for the shaft house are completed and the steel superstructure is being raised. The parts for the new hoisting equipment are on the ground and are being put in place.

WYANDOT—The winze being sunk on the No. 8 lode about 1100 ft. from the exploratory shaft has reached a depth of about 120 ft. and drifting will soon be started in each direction to test the formation. Developments so far on this formation has been the most consistent so far made on the property.

ISLE ROYALE—Preparations are being made to resume shaft sinking at the site of the new No. 7 shaft, which was suspended last winter owing to quicksand. Once the shaft is established in the lode progress will be made, as raises are being extended along the line of the shaft. Developments on the Grand Portage lode, being opened at three places, continue satisfactory.

CALUMET & HECLA—Development work at the White Pine property of this company, in which the copper occurs in sandstone, has recently been encouraging. The principal vein is about 6 ft. wide and contains about 4% of copper. Development work is made difficult by the frequency of faults, and diamond drilling is satisfactorily used in solving the fault problems. A raise is being lifted from the third level of No. 1 shaft, and will be continued to the surface. It parallels No. 1 shaft about 700 ft. to the west.

QUINCY—Operations at No. 8 shaft are giving excellent results. Sinking to the 57th level is going on and the Northern openings are showing ore above the average with a large amount of mass copper. Additional electrical haulage equipment has been installed recently at three more levels and the surface generating equipment has been enlarged. A new compound hoisting engine is being installed at this shaft and when ready to go into commission the present hoist will be moved to No. 9 shaft. No. 9 shaft is being sunk at a depth of about 2700 ft. and has been connected with No. 8 at the 20th level, where an electric tram is in operation. The rock is coming to surface through No. 8 shaft, but preparations are being made to handle the rock direct. Stations are being cut underground and changes are being made on surface.

Iron

CLEVELAND-CLIFFS IRON CO.—A diamond-drill has been started on the Peterson property west of Ishpeming near the Chase mine. An option was sought on this land for several years.

FLORENCE IRON CO.—This company operating on the Menominee range in Wisconsin has taken over the 80-acre tract in Forest County, formerly held by the Forest Mining Co. Iron formation is known to exist there.

M. A. HANNA & CO.—At the new Carpenter mine in the Crystal Falls district shaft-sinking has been progressing for several weeks. The drop shaft used to penetrate the thick overburden has been straightened, as it became twisted in sinking. New surface equipment machinery is being installed as it arrives. An electric transmission line has been constructed from the Carpenter to the Ravenna mine of the same company three miles to the northeast, and electric power will be furnished from a central power house at the Carpenter.

MINNESOTA

Cuyuna Range

ABOUT 600 MINERS WENT ON STRIKE, Apr. 8, because of dissatisfaction with a change in shifts, and also because a demand for a minimum scale of $3 for night work had been ignored. The present scale is $2.60. The mines affected are the Armour, Nos. 1 and 2, near Ironton, operated by the Rogers Brown company; the Kennedy, at Cuyuna, and the Thompson, at Crosby.

PITTSBURGH STEEL ORE CO.—The operations of removing the overburden at this property at Little Rabbit Lake, by hydraulic mining, have been begun.

Itasca County

JONES & LAUGHLIN—This company is reported to be making preparations for the exploration of iron lands near Grand Rapids. The company holds several options in that region, and several drills are to be operated. The drilling of the ground has been decided upon in spite of the fact that the Steel Corporation thoroughly explored it before making the leases recently canceled. It is now believed that fully half the tonnage of about 30,000,000, can be taken out by stripping. A washing plant, similar to that at Coleraine, is contemplated to treat a great quantity of concentrating ore existing on some of the ground.

Mesabi Range

PREPARATIONS FOR BEGINNING OF THE SHIPPING SEASON have been rushed to completion in the last few weeks, by the Great Northern and Missabe railroads. The first train of iron ore to leave the range for the season of 1913, was shipped over the Great Northern from Kelly Lake to the Allouez docks, Apr. 6. Loading is in progress at the Stevenson, Gavou, Croxton, White Iron, at both shafts at the Albany, and at the Grace and Leetonia, on the Great Northern, and at the Shenango and Webb shafts, shipping over the Missabe. The Stevenson was expected to begin loading from the pit last week. It was expected that several pits of the Olive Iron Mining Co. would resume operations this week. Contrary to expectations, the Lake Erie docks, Apr. 1, held only 6,728,035 tons of ore, 300,000 tons less than on the same date in 1912. Shipments were retarded by the washing out of railroad tracks and bridges during the latter part of March.

ROBERTS—Butler Bros., who have a lease on this mine near Nashwauk, are assembling material preparatory to stripping the property, which is expected to ship 200,000 tons of ore during this season, and steam shovels will shortly begin the work of removing the overburden. This will be an open-cut mine, and it is known to contain deposits of 1,000,000 tons of ore. The overburden is 23 ft. deep on the average.

SHENANGO FURNACE CO.—This is usually the first company to start shipping ore in the spring from the Mesabi range, and the last to suspend shipping at the close of the season. It will be one of the first of the mining companies to send ore to the docks at the Head of the Lakes for 1913.

MONTANA

Butte District

LA FRANCE COPPER CO.—The Atlantic Mining Co. has taken over the holdings of this company, including the Lexington group of silver and zinc mines at Butte, and the reduction works at Mason.

NORTH BUTTE—The Snowball vein, or a rich stringer, has been cut on the 2800-ft. level. It is richer and smaller than anticipated. If it proves to be only a stringer, the main vein will probably be reached in a few days.

BUTTE MAIN RANGE MINING CO.—This company organized by Butte men; capitalization $1,500,000 in $1, par, shares, is preparing to begin operations. The directors, most of whom are interested in the Tuolumne and Pilot-Butte companies, are, R. J. McDonald, Edward Hickey, Edward Hickey Jr., M. S. Largey, P. J. Brophy, Frank Girard, Patrick Sheehan, J. J. Harrington, all of Butte, and T. E. Murray, of St. Paul. The company owns 45 acres of mineral ground in the eastern portion of the Butte district, consisting of the Sinbad, Spread Delight, Rory O'More, and an interest in the Lillie claim. There are four wide veins traversing the property, and upon one of these on the Sinbad claim, M. S. Largey sunk a shaft 716 ft. deep, several years ago and opened some ore carrying copper and silver. Extensive development work will be commenced soon.

Broadwater County

LITTLE GIANT—The owners of this mine near Hassell, have begun hauling ore to Townsend, the nearest shipping point.

Granite County

ROYAL MOUNTAIN—The Cactus Copper Co. has taken an option on this gold mine and will soon begin extensive development of the property. About 3000 ft. of tunneling has been done by the owner, and ore has been treated in the mill. The Cactus company will continue the tunnel work, and expects to replace the mill by one of more modern design.

Jefferson County

PRICKLY PEAR—At a recent meeting held at Corbin, the following officers were elected for one year: J. C. Murray, of Helena, president; Lee Dever, vice-president and H. M. Brooks, secretary and treasurer. The company owns the Prickly Pear mine, near Jefferson. Operations have been going on during the last two years, during which time a tunnel was driven 347 ft. on the vein, and copper-silver, gold ore was blocked out. The mine was closed a few weeks ago, but at the meeting it was decided to resume operations.

Lewis & Clark County

EMPIRE—A lease on this old mine at Marysville has been taken by Edward Beadel and operations will be begun shortly.

ST. LOUIS—Work on the cyanide plant is progressing steadily under a force of 40 men, and it is expected to be ready to operate May 1. This company owns the St. Louis and Drumlummon mines, both good producers.

COPPER-SILVER MONTANA—This company, which owns claims in the Scratch Gravel Hills, about eight miles north of Helena, is engaged in sinking a two-compartment shaft. It has reached a depth of 320 ft. and will be continued to the 500-ft. level before development work is started. A vein was cut in the shaft at 300 ft. depth, the ore containing gold, silver, and copper.

NEVADA

Comstock Lode

MEXICAN—Ore shipments are being received at the mill from the Monte Cristo mine, 600 tons of $8 ore being treated recently.

CROWN POINT—Two new centrifugal pumps have been shipped and will be installed in the joint Crown Point-Belcher incline.

OPHIR—Higher-grade ore is being secured from the under-stope below the 2400-ft. level, and 20 tons of concentrate shipped from a run at the Kinkead mill will net the company $13,000. Net returns from the cyanide plant will increase the receipts for the month to nearly $25,000.

SIERRA NEVADA—Important developments are reported in the raise above the 2500-ft. level, where the rich streak first encountered at the sill floor has widened the full width of the raise. About 300 tons of ore have been mined and shipments have been begun to the Kinkead mill. This is the most important discovery made in the deep levels of the Comstock lode since the Mexican stope was opened two years ago.

Elko County

BLUSTER—It is reported that 51% of the stock of this Jarbidge company has been taken over by Chicago people, on a basis of $375,000 for the group. Under the agreement, a large mill is to be built this summer, and a tramway is to be built to connect the mine with the millsite on the river below.

TUSCARORA-NEVADA—A receiver has been appointed for this company, capitalized at $12,000,000. The company was forced into its present difficulties by a suit in equity for $86,000, filed by Melvin J. McKenna and William F. Grell, receivers for the Manhattan Securities Co. The petition of Grell and McKenna declares that the mines are mortgaged, one of them having been sold under the hammer. Among the mines are the Dexter, Grand Prize, Eira, Big Betsey and Young American.

Esmeralda County

GOLDFIELD CONSOLIDATED—The production in March is estimated as follows: Tons milled, 30,100; gross recovery $650,000; and $465,000 net profit.

Eureka County

A COMPLAINT AGAINST THE EUREKA & PALISADE R.R. has been made to the Nevada Railroad Commission, by the U. S. Smelting, Refining & Mining Co. This company owns

the Richmond-Eureka mine, at Eureka, and resumption of work at this property is desirable, as the ores, while low grade, are especially in demand for smelting purposes; but the claim is made that the railroad freight rates are too great to admit of placing the property in operation. Several years ago, the Eureka & Palisade R.R. was practically wiped out by a severe flood, and the property was sold at sheriff's sale to the United States company. The property, however, was redeemed by the original owners, and the line was rebuilt. Little business has been done, and little has been done in the mining camps tapped by the road, because of the alleged excessive freight rates. It is believed that, should these rates be reduced, there are many properties that could be profitably operated, in the vicinity of Eureka.

Lyon County

NEVADA DOUGLAS COPPER CO.—Stockholders are to be requested to authorize a bond issue, the proceeds from which will be used to carry out further development work. It is stated that the mine is now in condition to produce 500 tons of ore per day.

Nye County

TONOPAH MERGER—A new vein has been cut in the north crosscut on the 1070-ft. level., 580 ft. north of the shaft.

BELMONT—The cutting of a station on the 14th level, 1522 ft. below surface, has been commenced. The winze from the 13th level is now down 100 ft. on ore. The mill is treating more than 500 tons of ore daily.

SHIPMENTS in tons from Tonopah mines for the week ended Apr. 12, were as follows:

Tonopah Mining	3490	North Star	....
Tonopah Belmont	4093	Mizpah Extension	....
Montana-Tonopah	984	Jim Butler	400
Tonopah Extension	1060	Tonopah Merger	....
West End	1050		
Midway	50	Total	11,673
MacNamara	546	Estimated value	$252,905

NEW YORK

Sullivan County

ST. NICHOLAS—This old mine near Summitville has recently been examined. It was formerly worked for lead, but has been abandoned since the early '70s. The old mine contains zinc ore which it is proposed to mine.

OKLAHOMA

Pushmataha County

THE ALLEGED DISCOVERY OF RICH GOLD ORE, NEAR ALBION, has been investigated by engineers from the U. S. Geological Survey. They report that ore, claimed by the promoters to contain from $60 to $600 per ton in gold, is actually worthless. Secretary Lane, of the Department of the Interior, has referred the matter to Postmaster General Burleson for inquiry as to whether the mails are being used improperly in connection with this alleged discovery.

UTAH

Beaver County

MOSCOW—About half a car of good-grade silver-lead ore is being broken and mined daily.

MAJESTIC—Ore is being produced from three places, and has been opened both north and south in drifts on the 150-ft. level.

NOONDAY—The drift on the 210-ft. level is in limestone, mineralized with lead. This rock has been drifted in for about 20 feet.

Juab County

TINTIC SHIPMENTS FOR THE WEEK ENDED APR. 4 amounted to 199 cars. The Yankee Consolidated and Uncle Sam could not make shipments, owing to bad roads.

DRAGON CONSOLIDATED—Encouraging results are being obtained from development.

IRON BLOSSOM—Should the proposed new custom milling plant at Tintic become a reality and success, it will provide a market for some of this company's low-grade ores.

Salt Lake County

UTAH COPPER—The annual meeting will be held in Jersey City Apr. 25.

COLUMBUS EXTENSION—At the annual meeting Apr. 7 the following directors were elected: Lawrence Green, president, M. R. Evans, F. B. Cook, S. A. Whitney, and J. A. Walker.

CARDIFF—The lower tunnel reached the contact of quartzite and limestone at a distance of about 800 ft. from the portal. Drifting along the contact will be started. Where cut, it showed some mineralization. Ore hauling is to be resumed as soon as the roads are open. The snow in Big Cottonwood has been unusually deep this season.

BINGHAM MINES—The Yosemite shaft was connected with the Mascotte tunnel level, Apr. 6. The shaft was down 1160 ft. on an incline, and there remained 1066 ft. of raising from the Mascotte tunnel level to connect. The connections involved a survey of about 2½ miles, and were successfully made. This will afford the company drainage facilities and allow economical development, and operating of the Yosemite ground.

UTAH CONSOLIDATED—Two dividends of 50c per share each were paid during 1912, amounting in all to $300,000, from earnings of $603,923. The shaft is down to the 1200-ft. level, and drifting and diamond drill work is being done. The company is making shipments of copper ore to the International smeltery, and is also reported to be shipping about 200 tons of lead ore daily. The grade of the copper ore has decreased with depth, but it is proposed to sink the shaft another 100 ft., so that diamond drilling may be continued to find out if there is a zone of enrichment farther down. More attention than formerly is being given to lead ore.

CANADA

Ontario

AMERICAN SMELTING & REFINING CO.—Exploratory work for nickel ore in McKim township has been discontinued and it is reported that the company has withdrawn from activities in the nickel district for a time. The report that the company is interested fith Dr. F. S. Pearson in the equipment and operation of the Dominion company properties is denied. As far as is publicly known the company did not acquire any holdings in the district notwithstanding extensive investigations made last year for the company and negotiations for several properties.

Ontario-Cobalt

JAMES—Diamond-drilling operations have been going on for the last month.

FOLEY-O'BRIEN—It is understood that arrangements are being completed to begin active work at this mine Several men have already been brought in.

KEELEY—This property in the South Lorrain district, which was one of the assets of the defunct Farmers' Bank, has been taken over under a working option for one year by an English syndicate represented by Dr. J. M. Bell.

LITTLE PET—The plant of this mining company has passed into the hands of the bailiff and the seven-drill compressor, five-stamp mill, three drills, and other equipment will be sold by auction at Sudbury some time this month.

COBALT LAKE—A second dividend of 2½% with an additional bonus of ½% has been declared. Those shareholders who have deposited their stock in pursuance with the agreement made with the English syndicate will receive dividends on that portion of the stock which has not yet been taken up.

SHIPMENTS of ore and concentrates in tons, from Cobalt mines for the week ended Apr. 12, were as follows:

Bailey	....	Kerr Lake	....
Beaver	....	La Rose	....
Buffalo	....	Lost and Found	....
Casey Cobalt	20.25	McKinley-Darragh	37.84
Chambers-Ferland	....	Nipissing	30.45
City of Cobalt	....	Nipissing Reduction	....
Cobalt Lake	32.60	O'Brien	....
Cobalt Townsite	....	Penn.-Canadian	32.62
Colonial	....	Provincial	....
Coniagas	....	Right of Way	....
Crown Reserve	21.35	Seneca Superior	....
Dominion Reduction Co.	....	Silver Bar	20.00
Drummond	....	Silver Queen	....
General Mines	....	Timiskaming	....
Green Meehan	....	Trethewey	....
Hargraves	....	Wettlaufer	....
Hudson Bay	....		
		Total	195.11

Ontario-Porcupine

MINIKER-CLAIMS—These properties south of Kirkland Lake, have been taken over by a Haileybury syndicate.

FOLEY-O'BRIEN—C. L. Sherrill and associates, of Buffalo, N. Y., have taken an option on about 285,000 shares of the stock of this company, giving a controlling interest. It is proposed to place the control in the hands of the Homestake Mining & Finance Co., capitalized at $1,000,000, which will take over other holdings of the Sherrill interests

MEXICO

Mexico

EL ORO MINING & RY. CO.—In March, 20,970 tons of ore and 16,330 tons of tailings were treated, yielding bullion worth $179,970, the net profit being $61,280.

Oaxaca

SAN MARTIN DE LOS CONSEJOS—The new 10-stamp mill is nearing completion; it will probably be put in commission about June 1. A Westinghouse steam-turbine generator, B. & W. boiler, Pachuca tanks, Dorr thickeners and Merrill press are being installed.

BELGIUM

ABOUT 100,000 COAL MINERS WENT OUT ON STRIKE Apr. 13, seeking to compel the government to bring in a bill establishing manhood suffrage; it is thought that the number of strikers will be greatly increased in a few days.

SOUTH AMERICA

Venezuela

THE MAGNESITE DEPOSITS ON THE ISLAND OF MARGARITA are being actively developed and a large tonnage of high-grade product is reported available. A New York syndicate represented by L. D. Freeman is chiefly interested in the operations which have been under way for several years now.

CARRIBEAN COAL CO.—An American company, represented by L. C. Butler of 71 Wall St., New York, is investigating an extensive coal deposit and proposes to develop it extensively.

CANADIAN VENEZUELAN ORE CO., LTD.—This Montreal company announces a bond issue of $1,000,000 to provide for improvements and a fleet of river boats for the operations of its iron ore property at Imataca on the Orinoco River. The company has made a contract to ship 500,000 tons to the Allen-Wood Iron & Steel Co., of Philadelphia. The first four cargoes shipped gave an average analysis of 66.68% iron, 2.09% silica, 0.03% phosphorus. 0.03% sulphur, 0.74% titanium. The ore is mined opencast and about 20,000,000 tons is said to be available. F. P. Jones of Montreal is president and Sir William Van Horne, vice-president.

AFRICA

Transvaal

Gold production in March was 790,522 oz., being 36,410 oz. more than in February, but 40,191 oz. less than in March, 1912. For the three months ended March 31 the total output was 2,271,589 oz. in 1912, and 2,314,064 oz., or $47,831,703, in 1913; an increase of 42,475 oz. this year.

THE MARKET REPORT

METAL MARKETS

NEW YORK—April 16

The metal markets generally have shown only moderate changes for the week. There appears to be rather a firm undertone both here and abroad.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	...	Sept.	127	...
Feb.	109	125	June	117	...	Oct.	133	...
March	111	125	July	114	...	Nov.	129	...
April	115	...	Aug.	120	...	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year 1910, 115; year 1909, 115.

Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Copper, Tin Lead and Zinc

Copper—There has been a very good-sized business for export as well as for home trade, the export business predominating. Recent sales have been so heavy that producers are well booked up and they are not inclined to let additional quantities go except at higher prices. This explains the steady advance, which under other conditions would hardly have taken place considering that the volume of business has by no means been out of the ordinary. Sales were made at 15½c., delivered, usual terms up to Monday, when 15⅝c. was received, the demand being apparently unchecked. This led certain of the agencies to advance their asked price to 15¾c., but there continued to be sellers at 15⅝c. The close is firm at 15½@15¾c. for Lake copper, and 15.40@15.50c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 15.20@15.25 as an average for the week.

The standard market, after advancing under bear covering and selling as high as £69 15s. for spot and £69 10s. for three months on April 14, eased off somewhat toward the close, which is cabled at £68 10s. for spot and £68 13s. 9d. for three months.

Base price of copper sheets is 21@22c. per lb. Full extras are charged, and higher prices for small quantities. Copper wire is 16½c. carload lots at mill.

Copper exports from New York for the week were 5955 long tons. Our special correspondent gives the exports from Baltimore at 3137 tons for the week.

Tin—The market evinced a very strong tone throughout the past six days Transactions on the London Metal Exchange assumed large proportions, and prices, especially at the beginning of this week, advanced vigorously. The reasons given for this bullish activity are the easier money situation abroad and the very healthy statistical position of the metal. Buying in this market during last week was satisfactory, but the rapid advance the beginning of this week made consumers hesitant. The market closes firm at £227 5s. for spot and £221 15s. for three months, and at about 49.75c. for April tin here.

Messrs. Robertson & Bense report arrivals of tin ore and concentrates at Hamburg, Germany, in March at 1643.5 tons, of which 1335 tons were from Bolivia and 8.5 tons from German Southwest Africa.

Lead—The St. Louis market is reported a little better at 4.17½@4.20c. Prices at New York are unchanged at 4.30@4.35 cents.

The causes which brought about the recent advances abroad are still at work, and prices have again moved forward rapidly, the close being cabled as firm at £18 15s. for Spanish lead and 7s. 6d. higher for English.

Spelter—The demand has been very light, which is partly explained by the disorganization of the business of galvanizers in Pennsylvania and Ohio, due to the floods, as the two to three weeks during which a great many plants have been shut down mean practically an entire loss of the business which would otherwise have taken place during that period. Smelters who are anxious to place spelter against their current purchases of ore have great difficulty in finding a market, even though concessions have again been offered in price. Quotations at the close are weak at 5.40@5.50c. St. Louis, and 5.55@5.65c. New York.

The London market is somewhat firmer at £25 7s. 6d. for good ordinaries, and £25 15s. for specials.

Base price of zinc sheets is $8 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Imports and Exports in Great Britain of metals other than iron and steel, are reported for the two months ended Feb. 28, as follows, in long tons, except quicksilver, which is in pounds:

	Imports 1912	Imports 1913	Exports 1912	Exports 1913
Copper	23,897	19,332	10,257	12,984
Tin	8,357	8,771	8,297	8,123
Lead	30,612	30,943	7,497	9,432
Zinc	23,972	23,217	1,306	1,265
Quicksilver, lb.	992,325	855,684	469,125	455,400
Minor metals	1,155	1,342	4,318	5,051
Ores, etc.:				
Tin ore	4,095	5,510	.....	.....
Pyrites	174,306	170,373	.....	.....

Exports include reëxports of foreign material. Copper figures include metallic contents of ore and matte.

DAILY PRICES OF METALS

NEW YORK

Apr.	Sterling Exchange	Silver	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
10	4.8685	60¾	15½ @15⅝	15.25 @15.35	48¾	4.30 @4.35	4.17½ @4.20	5 65 @5.75	5.50 @5.60
11	4.8660	60	15½ @15¾	15.30 @15.35	49⅛	4.30 @4.35	4.17½ @4.20	5.65 @5 70	5.50 @5.55
12	4.8640	60	15½ @15¾	15.30 @15.35	49⅛	4.30 @4.35	4.17½ @4.20	5.60 @5 70	5.45 @5.55
14	4.8640	59¾	15½ @15¾	15.35 @15.45	50⅛	4.30 @4.35	4.17½ @4.20	5 60 @5.65	5.45 @5.50
15	4.8645	59¼	15½ @15½	15.40 @15.50	49⅜	4.30 @4.35	4.17½ @4.20	5.60 @5.65	5.45 @5.50
16	4.8645	59¼	15½ @15½	15.40 @15.50	49¾	4.30 @4.35	4.17½ @4.20	5.55 @5.65	5.40 @5.50

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Apr.	Silver	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
10	27⅜	68⅜	68⅛	74⅛	220¼	216¾	17⅜	25⅛
11	27⅜	69	68⅝	74⅛	222½	217⅞	17⅜	25¼
12	27 11/16	....	....	....	....	....	....	....
14	27 13/16	69⅜	69⅛	75½	229	223	18⅛	25¼
15	27 13/16	69 1/16	68 15/16	75¼	227	221½	18⅛	25⅛
16	27⅛	68⅜	68 15/16	75	227½	221⅞	18⅛	25⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, pot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21½c.

Other Metals

Aluminum—The market has been rather dull, with less business than for some time past. Prices are rather easier 26¾@27¼c. per lb. being asked for No. 1 ingots, New York.

Antimony—There is hardly any business doing; everyone is waiting to see what action will be taken on the tariff. Prices are nominally unchanged, Cookson's being quoted at 9@9.25c. per lb. and Hallett's at 8.50@8.75c.; while 7.90@8.25c. is asked for Hungarian, Chinese and other outside brands.

Quicksilver—The market remains quiet, and there is no material change in prices. The New York quotation may be given at $39@40 per flask of 75 lb., with 58@59c. per lb. for small lots. San Francisco $40 for domestic orders and $37.g0 for export. London price is £7 10s. per flask, with £7 2s. 6d. named from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Gold, Silver and Platinum

Gold—The price on the open market in London continued at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving went to the Bank of England.

The Mexican Chamber of Deputies on April 15 passed the law imposing a duty of 10% on all gold exported from Mexico. It is now before the Senate.

Sales of gold bars at the New York Assay Office in March amounted to $2,828,363, being $237,122 more than in February, and $628,091 more than in March, 1912. For the three months ended March 31 the total sales were, $6,896,396 in 1912, and $8,308,165 in 1913; an increase of $1,411,769. These sales are chiefly to jewelers and others, for use in the arts.

Gold in the United States Apr. 1, as estimated by the Treasury Department: Held by Treasury against gold certificates outstanding, $1,068,610,169; in Treasury current balances, $182,824,252; in banks and circulation, $607,135,473; total, $1,858,569,894. This is a decrease of $8,650,804 during March.

Gold Production in the Transvaal for the three months ended March 31, was $47,831,703, an increase of $877,958 over last year.

Iridium—There is no improvement in supplies and quotations continue at $85 per oz., New York.

Platinum—The market continues steady with a fair business. Dealers here ask $45@46 per oz. for refined platinum and $49@53 for hard metal. The latest London quotation is £9 5s.—equal to $45—per oz. for refined platinum.

Silver—The market shows a slight tendency to lower quotations, but best opinions are that not much lower prices are at present probable.

Exports of silver from London to the East, Jan. 1 to Apr. 3, reported by Messrs. Pixley & Abell:

	1912	1913	Changes	
India	£1,830,800	£2,178,000	I.	£347,200
China	465,000	95,000	D.	370,000
Total	£2,295,800	£2,273,000	D.	£ 22,800

Exports of silver from New York week ended Apr. 12 were $1,281,253, chiefly to London. Imports were $114,277, chiefly from Central America.

Zinc and Lead Ore Markets

JOPLIN, MO.—Apr. 12

The high price of zinc blende is unchanged at $49, and the high base is unchanged at $44, the low base being advanced $1 to $41 per ton of 60% zinc. Calamine sold at $19@22 per ton of 40% zinc. The average is $41.48 per ton. Lead ore sold as high as $55, the base ranging from $53@53.50 per ton of 80% metal contents, with a weaker market at the week-end. The average of all grades of lead is $53.36 per ton.

SHIPMENTS, WEEK ENDED APRIL 12

	Blende	Calamine	Lead ore	Value
Totals for the week	14,036,930	359,730	1,846,550	$347,985
15 weeks	158,449,460	10,448,470	28,218,410	4,665,368

Blende value, the week, $294,252; 15 weeks, $3,771,884.
Calamine value, the week, $4462; 15 weeks, $147,555.
Lead value, the week, $49,271; 15 weeks, $745,928.

PLATTEVILLE, WIS.—April 12

The base price paid this week for 60% zinc ore was $40@44. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED APRIL 12

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	1,564,500	.....	2,038,710
Year to date	40,948,410	1,638,440	17,535,510

Shipped during week to separating plants, 2,234,430 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—April 16

The western mills are now pretty well recovered from their flood troubles, but transportation is still rather uncertain.

New business comes forward in fair volume. Structural orders are good, while bars remain in demand. The Standard Oil Co. is reported to have placed an order for 100,000 tons of plates with the Steel Corporation, to cover the year's requirements for steel pipes. Railroad orders for cars are slow, and will probably continue so until the car shops begin to work up closer to their present orders.

The pig-iron market is still rather uncertain. Some demand for basic iron is in evidence, but foundry orders, though quite numerous, are generally for moderate quantities. Prices are inclined to be weak. There are plenty of inquiries for third-quarter iron, but they have not led to heavy business so far.

Pig Iron Production—The reports of the furnaces as collected and published by the "Iron Age" show that on April 1 there were 293 coke and anthracite stacks in blast, having a total daily capacity of 89,950 tons; a decrease of 3150 tons from Mar. 1. Allowing for the charcoal furnaces, the production of pig iron in the United States in March was 2,798,600 tons; for the three months ended Mar. 31 it was 8,250,000 tons. Of this total 5,678,600 tons, or 68.8%, were made by furnaces owned or operated by steel companies.

The Lackawanna Steel Co. reports unfilled orders of March 31 at 623,816 tons, which is 3160 tons less than on Dec. 31, but 222,341 tons more than on March 31, last year. The United States Steel Corporation reports unfilled orders on its books March 31 at 7,468,956 tons of material, a decrease of 187,758 tons during March. The total has been exceeded each month since October last; but previous to that it has not been equaled in any month since June, 1907, over five years.

The German Iron & Steel Union reports pig iron made in February at 1,492,511 metric tons; this is 117,203 tons less than in January, but the daily average in February was higher, 53,304 tons, which is 1378 tons more than in January For the two months ended Feb. 28, the make was:

	1912	1913	Changes	
Foundry iron	503,490	579,329	I.	75,83
Forge iron	90,084	88,193	D.	1,89
Steel pig	357,766	421,850	I.	64,084
Bessemer pig	55,991	61,776	I.	5,785
Thomas (basic) pig	1,715,296	1,951,077	I.	235,781
Total	2,722,627	3,102,225	I.	379,598

The total increase this year was 13.9%. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

PITTSBURGH—Apr. 15

Reports of the finished-steel trade are less encouraging. Some mills note a distinct falling off in specifications in the first half of April, compared with the first half of March, and in some cases the specifications are coming in at a materially less rate than steel is being shipped, which is contrary to the experience of the first three months of the year, when specifications in nearly all products were in excess of shipments, though there was no great gain in the total specifications on books, comparing Jan 1 and Apr. 1. As to strictly new business, it is very light in all lines, but this has been more or less the case since before the holidays, the activity meanwhile having been in specifying against contracts.

In cases in which decreased business is noted, the opinion is invariably expressed that the hesitancy is due to the impending tariff revision. It is not altogether that buyers expect to have lower prices as a direct result of reduced duties on iron and steel; it is rather that they regard it is probable, or at least possible, that general business will slow down, and this might tend to pull down steel prices, and would at any rate make it easy to secure desired deliveries, without contracting far ahead.

The National Tube Co., by a new card dated Apr. 12, has advanced its prices on steel pipe, including line pipe, by about $1 a ton, the regular discounts being lowered by one-half point, making ¾- to 3-in. butt weld 79½ per cent. off list. The advance was based on an increase in specifications received during the first half of April. There were some slight irregularities in prices, and with this advance these are expected to be straightened out, heavier specifications coming in on old contracts. The independents are issuing new lists, conforming to the new discounts of the leading interest.

Pig Iron—The market has continued to soften, and somewhat more rapidly than formerly. Several of the Valley furnaces are actively seeking orders for foundry iron, through the medium of cut prices, and several are now quoting foundry down to $15.50, Valley, 75c. lower than last week's quotation and $2.50 below the market prevailing the middle of last December. Basic has yielded slightly, being available at $15.75, Valley, as is malleable. Late last week a sale of 5000 tons of bessemer iron was made, at $17, Valley, the reduced price lately quoted, and bessemer is thus holding much better than other grades, since it was not quotable above $17.25 on this movement. Buyers are showing very little interest in the market, and all the indications are that the decline will not be arrested until it has gone far enough to catch the cost line of some furnaces, putting them out of blast. It would require only a very moderate decrease in production to change the complexion of the market, for consumption is heavy, probably as heavy as at any time. We quote: Bessemer, $17; basic and malleable, $15.75; No. 2 foundry, $15.50; forge, $15, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is quiet, buyers showing no interest since the English producers formally cut their price $4 a ton. This was the first decline since the market started advancing late in 1911. It is possible that middle interests would cut the new price, by going short, as they did the old price. We quote prompt and forward at $61, Baltimore, the new freight rate to Pittsburgh being $2 per ton.

Steel—It is reported that the Carnegie Steel Co. has purchase 15,000 tons of openhearth steel billets from the Alan Wood Iron & Steel Co., Philadelphia, for early delivery to the Pencoyd works, the price not being reported. There is practically no steel available in the market for early delivery, and prices are nominally unchanged, at about $29 for billets and $30 for sheet bars, f.o.b. maker's mill, Pittsburgh or Youngstown. Recently a Youngstown interest which is completing an openhearth addition to its steel plant sold considerable tonnages for second-half delivery, with shipments starting in June if the plant is completed in time, at $27.50 at mill for openhearth sheet bars. Wire rods continue quotable at $30, Pittsburgh.

IRON ORE

The first cargo of the season from the Wabana mines in Newfoundland is expected next week.

Vessels continue scarce, and even from Cuba there is some delay in shipping iron ore.

As a result of the recent action of the Interstate Commission, there has been a reduction of 10 or 12% in railroad rates on ore from New Jersey and the Hudson River district in New York to furnaces in eastern Pennsylvania.

COKE

Coke production improved last week in the Connellsville district, and shipments are being made more freely. The make, however, is not yet up to the average of the past few weeks. The market has been steady and quiet, and prices show little change. The main trouble now is with transportation and cars are scarce, even where the roads have been pretty well repaired. Most furnaces, however, are recovering from the effects of the floods, with little delay.

CHEMICALS

NEW YORK—April 16

The general market remains rather quiet. Contract trade shows steady deliveries, but new business is only moderate.

Arsenic—The market is flat, with little buying. Prices are weaker, $3.90@4.12½ per 100 lb. being asked.

Copper Sulphate—There is a fair business forward. Prices are unchanged at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is quiet and steady, but there is plenty of business doing. Quotations remain about the same, 2.62½c. per lb. being asked for April, 2.60c. for May, 2.57½c. for June, and 2.55c. per lb. for July and later deliveries.

PETROLEUM

The "Petroleum Review of London makes the following comparison of the world production in 1907 and 1912, the figures being in metric tons:

	1907		1912	
	Tons	Per ct.	Tons	Per ct.
United States	21,753,770	61.8	29,663,927	63.0
Russia	8,443,129	24.0	9,263,566	19.7
Roumania	1,129,097	3.2	1,806,942	3.8
Galicia	1,175,975	3.4	1,180,568	2.5
Dutch East Indies	1,345,975	3.8	1,520,000	3.2
Mexico	133,000	0.4	2,100,000	4.5
Other countries	1,212,561	3.4	1,565,000	3.3
Total	35,193,507	100.0	47.100,003	100.0

The United States in the five years has more than held its place. Outside of that the chief change has been the appearance of Mexico among the important producers.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

	Dec.	Jan.	Feb.	March
Alaska shipments	3,766,029	1,668,328	660,250	472,293
Anaconda	23,400,000	21,000,000	21,250,000	22,900,000
Arizona, Ltd	3,100,000	3,100,000	3,000,000	3,200,000
Copper Queen	8,805,568	7,554,966	6,810,706	7,558,709
Calumet & Arizona	5,840,000	4,750,000	4,050,000	.....
Chino	3,368,850	2,903,030	3,813,998	4,449,884
Detroit	2,389,875	1,769,071	1,689,277	1,640,671
East Butte	1,314,021	1,469,000	1,325,000	1,400,000
Mammoth	1,850,000	1,957,804	1,661,150	.....
Giroux	625,000	650,000	.....	.....
Mason Valley	1,550,000	1,575,100	.....	.....
Nevada Con.	3,975,631	4,169,705	4,798,531	.....
Ohio	566,816	492,760	389,940	.....
Old Dominion	2,727,000	2,727,000	2,381,000	2,853,000
Ray	3,638,500	3,610,000	3,610,000	4,287,400
Shannon	1,361,420	1,232,000	1,152,000	1,260,000
South Utah	*nil*	*nil*	*nil*	.....
United Verde*	3,000,000	2,900,000	2,750,000	.....
Utah Copper Co	5,676,484	7,182,495	7,585,303	.....
Lake Superior*	18,300,000	17,500,000	19,000,000	19,000,000
Non-rep. mines*	7,750,000	7,500,000	.....	.....
Total production	103,005,194	95,711,259	.....	.....
Imports, bars, etc	28,761,087	34,026,236	.....	.....
Total blister	131,766,281	129,737,495	.....	.....
Imp. in ore and matte	10,385,662	7,563,758	.....	.....
Total American	142,151,943	137,301,253	.....	.....
Miami†	2,913,840	2,932,369	2,817,200	3,102,200
Brit. Col. Cos.:				
British Col. Copper	.....	.....	.....	.....
Granby	.....	1,792,245	1,740,000	2,020,462
Mexican Cos.:				
Boleo†	2,480,240	2,658,880	2,535,680	2 204,720
Cananea	5,592,000	.....	4,880,000	4,772,000
Moctezuma	2,793,781	2,913,294	2,730,914	3,062,159
Other Foreign:				
Braden, Chile	910,000	1,484,000	1,178,000	1,472,000
Cape Cop., S. Africa	750,560	770,540	.....	.....
Kyshtim, Russia	1,489,600	1,644,160	.....	.....
Spassky, Russia	974,400	974,400	1,003,520	.....
Exports from				
Chile	7,392,000	6,752,000	5,824,000	7,840,000
Australia	9,856,000	9,744,000	5,512,000	6,944,000
Arrivals in Europe‡	16,363,200	17,689,280	8,509,760	15,585,920

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
III, '12	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186.757
V	126,737,836	72,702,277	69,485,945	695,066,02	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	.....	.....	.....	104,269,270	87,180,800	191,450,070

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Atlas Wonder, Nev.	Apr. 21	May 14	$0.01
Caledonia, Nev.	Apr. 9	Apr. 29	0.05
Cariboo, Ida.	Apr. 5	May 1	0.0½
Central Eureka, Calif.	Mar. 22	Apr. 26	0.02½
Challenge, Nev.	Apr. 1	Apr. 22	0.05
Chollar, Nev.	Mar. 31	Apr. 24	0.03
Columbus Extension, Utah.	Apr. 19	Apr. 26	0.02
Con. Imperial, Nev.	May 6	May 28	0.01
Con. Virginia, Nev.	Apr. 23	May 14	0.15
Corbin Copper, Mont.	.....	Apr. 22	0.50
East Hercules Ext., Ida.	Apr. 15	.....	0.001½
Great Falls, Utah.	Mar. 22	Apr. 22	0.0½
Great Ruby, Calif.	Apr. 17	May 7	0.10
Gypsy Queen, Nev.	Mar. 31	May 5	0.01
Imlay, Nev.	Apr. 10	Apr. 29	0.01
Lehi Tintic, Utah.	Apr. 15	May 7	0.0½
Little Cottonwood, Utah.	Apr. 17	May 8	0.0½
Michigan Cop. & Gold, Utah	Mar. 31	Apr. 22	0.0½
O. K. Silver, Utah.	Apr. 15	May 10	0.0½
Ophir, Nev.	Apr. 16	May 8	0.15
Pioneer Cons., Ariz.	Apr. 1	Apr. 23	0.005
Rainbow, Ida.	Apr. 5	Apr. 25	0.001
Seg. Belcher, Nev.	Apr. 8	Apr. 29	0.02
Sierra Nevada, Nev.	Apr. 2	Apr. 23	0.10
Silver Rock, Ida.	Apr. 5	Apr. 26	0.001
Wandering Jew, Utah.	Mar. 31	Apr. 21	0.01

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28 983
February	52.222	59 043	61.642	24.081	27.190	28 357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62 893	65.519
March	14 698	14.713	14.868	14.930	65.884	65.329
April	15 741	.....	15.930	.....	70.294	.....
May	16.031	.....	16 245	.....	72.352	.....
June	17 234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78 670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42 529	50.298	191.519	238.273
February	12.962	48.766	195.036	220.150
March	12.577	46.832	192.619	213.645
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4 435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3 946	4.175	15 738	16.550
March	4.073	4.327	4.046	4.177	15 997	15.977
April	4.200	.....	4 118	.....	16.331	.....
May	4 194	.....	4 072	.....	16 509	.....
June	4 392	.....	4.321	.....	17 588	.....
July	4 720	.....	4.603	.....	18 544	.....
August	4 569	.....	4 452	.....	19 655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20 630	.....
November	4.615	.....	4.463	.....	18 193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6 089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	.....	6 483	.....	25 644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6 727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26 494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14 90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17 09	.....	18 00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 15

Name of Comp.	Bid.
Acacia	.02⅜
Cripple Cr'k Con.	.01
C. K. & N.	.16
Doctor Jack Pot	.07½
Elkton Con.	.58½
El Paso	4.50
Findlay	.04
Gold Dollar	.10½
Gold Sovereign	.02½
Isabella	.12
Jack Pot	.05½
Jennie Sample	‡.01
Lexington	‡.008
Moon Anchor	‡.005
Old Gold	.02½
Mary McKinney	.63½
Pharmacist	.01
Portland	.97
Vindicator	.93½
Work	‡.004

SALT LAKE Apr. 15

Name of Comp.	Bid.
Beck Tunnel	.07
Black Jack	.10
Cedar Talisman	‡.02
Colorado Mining	.13
Columbus Con.	.04
Crown Point	.03½
Daly-Judge	6.00
Grand Central	.77
Iron Blossom	1.40
Little Bell	‡.35
Lower Mammoth	.03
Mason Valley	6.00
May Day	.11
Nevada Hills	1.00
New York	.01
Prince Con	.61
Silver King Coal'n	3.55
Sioux Con.	.03
Uncle Sam	.06
Yankee	.10

TORONTO Apr. 15

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.09½	Foley O'Brien	.26
Coniagas	8.00	Hollinger	18.00
T. & Hudson Bay	‡64.00	Imperial	.03½
Timiskaming	35	Jupiter	.49
Wettlaufer-Lor.	16	Pearl Lake	.49½
Apex	‡.02½	Porcu. Gold	.23
Crown Chartered	.00¾	Preston E. D.	‡.04
Dobie	‡.15	Rea	.29
Dome	‡17.50	Swastika	.11
Dome Exten.	10	West Dome	‡.24½

SAN FRANCISCO Apr. 15

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.08	Belmont	6.25
Belcher	.25	Jim Butler	1.07½
Best & Belcher	.03	MacNamara	.21
Caledonia	1.60	Midway	.51
Challenge Con.	.06	Mont.-Tonopah	1.75
Chollar	.03	North Star	.35
Confidence	.33	West End Con.	1.27½
Con. Virginia	.10	Atlanta	.16
Crown Point	.20	Booth	.06
Gould & Curry	.03	C.O.D. Con.	.06
Hale & Norcross	.05	Comb. Frac.	.05
Mexican	.75	Jumbo Extension	.25
Occidental	.70	Pitts.-Silver Peak	.50
Ophir	.22	Silver Pick	.07
Overman	.40	St. Ives	‡.30
Potosi	.02	Tramp Con.	‡.01
Savage	.04	Argonaut	2.00
Sierra Nevada	.32	Bunker Hill	‡1.50
Union Con.	.12	Central Eureka	.18
Yellow Jacket	.25	So. Eureka	‡2.75

N. Y. EXCH. Apr. 15

Name of Comp.	Clg.
Amalgamated	76¾
Am. Agri. Chem.	52
Am. Sm. & Ref., com	69½
Am. Sm. & Ref., pf.	103⅞
Am. Sm. Sec., pf. B	85¼
Anaconda	38½
Batopilas Min.	1⅜
BethlehemSteelpf	71
Chino	41¼
Federal M. & S., pf.	34
Goldfield Con.	2¼
GreatNor. ore, ctf.	31¼
Guggen. Exp.	43¾
Homestake	103
Inspiration Con.	18⅜
Miami Copper	25⅛
Nat'nalLead, com.	49¾
National Lead, pf.	105½
Nev. Consol.	17½
Phelps Dodge	2 0
Pittsburg Coal, pf.	81½
Ray Con.	18¾
Republic I&S, com.	24¾
Republic I & S, pf.	84½
SlossSheffi'd, com.	35
Sloss Sheffield, pf.	90¼
Tennessee Copper	35¾
Utah Copper	53½
U. S. Steel, com.	61⅞
U. S. Steel, pf.	108
Va. Car. Chem., pf.	107½

N. Y. CURB Apr. 15

Name of Comp.	Clg.
Barnes King	1.02
Beaver Con.	.38
Braden Copper	8⅛
B. C. Copper	2¾
Buffalo Mines	2⅝
Caledonia	‡.40
Con. Ariz. Sm.	¼
Davis-Daly	2⅛
Diam'field-Daisy	.04
Ely Con.	.10
Florence	⅛
Giroux	2½
Gold Hill Con.	‡⅛
Greene Cananea	7⅜
Greenwater	.05
Internat. S. & R.	‡117
Kerr Lake	3 5/16
Keystone	‡2
La Rose	2⅜
McKinley-Dar-Sa.	2
Min. Co. of A. new	2⅛
Motherlode Gold.	‡.60
Nev. Utah M. & S.	‡.01
Nipissing Mines	9
Ohio Copper	⅛
Pacific Sm. & M.	⅛
Puebla S. & R.	2⅛
South Live Oak	‡2
South Utah M. & S.	3/16
Standard Oil (Old)	‡1110
Stand'd Oil of N.J.	358
Stewart	1⅛
Tonopah	5⅜
Tonopah Ex.	2⅜
Tonopah Merger.	1⅛
Tri-Bullion	3/16
Tularosa	5/16
Union Mines	‡1⅛
United Cop., pfd.	3½
Yukon Gold	2¼

LONDON Apr. 15

Name of Com.	Clg.
Camp Bird	£0 19s 3d
El Oro	0 15 1
Esperanza	1 8 4
Mexico Mines	‡6 15 10
Oriental Con.	‡1 8 9
Oroville	0 5 8
Santa Gert'dis	1 4 8
Tomboy	1 4 2

BOSTON EXCH. Apr. 15

Name of Comp.	Clg.
Adventure	2¼
Ahmeek	300
Algomah	1¼
Allouez	35¼
Am. Zinc	27½
Ariz. Com., ctfs.	3½
Bonanza	.38
Boston & Corbin	6
Butte & Balak	2⅛
Calumet & Ariz.	66
Calumet & Hecla.	475
Centennial	15
Cliff	1¼
Copper Range	44
Daly West	3
East Butte	12½
Franklin	6¾
Granby	60½
Hancock	21⅛
Hedley Gold	31
Helvetia	¼
Indiana	12
Island Cr'k, com.	52
Island Cr'k, pfd.	84
Isle Royale	26¼
Keweenaw	2
Lake	14⅞
La Salle	4⅝
Mass	4½
Michigan	1¼
Mohawk	52
New Arcadian	2
New Idria Quick.	3⅞
North Butte	29½
North Lake	1¼
Ojibway	2
Old Dominion	49
Osceola	90
Quincy	70
Shannon	11¼
Shattuck-Ariz.	24
Superior	31¾
Superior & Bost.	3⅜
Tamarack	30
Trinity	4
Tuolumne	2⅝
U. S. Smelting	41¾
U. S. Smelt'g, pf.	48¾
Utah Apex	1¾
Utah Con.	9
Victoria	1
Winona	2¼
Wolverine	60½
Wyandot	1⅛

BOSTON CURB Apr. 15

Name of Comp.	Last
Alaska Gold M.	13½
Bingham Mines	4
Boston Ely	.65
Boswyocolo	‡.01
Butte Central	2½
Cactus	.10
Calaveras	2¾
Chief Cons	1⅞
Corbin	.70
Cortez	.48
Crown Reserve	3¾
Eagle & Blue Bell.	1
First Nat. Cop.	2½
Majestic	.42
Mexican Metals	1½
Moneta Porc.	‡.06
Nevada-Douglas	1⅞
New Baltic	1
Oneco	1½
Raven Copper	.15
Rhode Island Coal	.06
Smokey Dev.	1½
S. W. Miami	2⅞
South Lake	6½
Trethewey	.40
United Verde Ext.	.67

‡Last quotation.